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1. **PIOTR CZECH, BOGUSŁAW ŁAZARZ, HENRYK MADEJ, GRZEGORZ WOJNAR**
**CLASSIFICATION OF TOOTH GEAR WHEEL FAULTS OF GEARBOX WORKING IN
THE CIRCULATING POWER TEST RIG BY MULTILAYER PERCEPTRON AND
CONTINUOUS WAVELET TRANSFORM** 15

■ **Abstract:**

In the article the results of the attempts are presented to build a classifier of the local teeth damages in gear wheels, based on artificial neural networks. In the tests the neural networks of a multilayer perceptron type (MLP) were used. The research object was a toothed gear with straight teeth, working on a rotating power stand FZG. Both the undamaged gears and gears with local teeth damages in the form of crack in the tooth base and the crumbling of a tooth tip were tested. In the article, it is suggested to build a descriptor of wheel teeth local damages with the use of vibration signals which were properly filtered and processed.

2. **JIŘÍ BOBEK**
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■ **Abstract:**

This paper is next of the papers series which is biodegradable plastics properties considering. Concretely biopolymer HL103 was chosen for this series. Biologic degradation was realized in nature compost and acid and alkaline solution. Mechanical properties change was observed in dependence on time after production. Testing specimen production was realized by injection molding.

3. **TADEUSZ ZABOROWSKI**
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FOR MANUFACTURING PROCESSES** 25

■ **Abstract:**

This paper described role of materials selection for the design and manufacturing processes of new, needed products, having the highest attainable quality and performance at the optimum and reasonably set - possibly lowest cost level. The review of the long history of human civilisation indicates that the significant increase of the level of living and production is connected most often with introduction of new material groups, having their properties adjusted better and better to the real customers requirements that get more sophisticated nearly each day, and having also the technological processes relevant to them. The reasons given, make it possible to forecast that the future of the market and products on it, with the required properties, are inseparably connected with the development of Engineering Materials.

4. **IMRE KISS, VASILE GEORGE CIOATA, VASILE ALEXA**
**INCREASING THE ROLLING-MILL ROLLS QUALITY - IN SOME MULTIDISCIPLINARY
RESEARCH** 31

■ **Abstract:**

Quality assurance is the activity of providing evidence needed to establish quality in work, and that activities that require good quality are being performed effectively. All those planned or systematic actions necessary to provide enough confidence that a product or service will satisfy the given requirements for quality. Quality assurance covers all activities from design, development, production, installation, servicing and documentation. It includes the regulation of

the quality of raw materials, assemblies, products and components, services related to production, and management, production, and inspection processes. Our approaches the issue of quality assurance of the rolling mills rolls, from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation. The experimented durability research, as well as the optimization of the manufacturing technology, allows the conclusion of direct results for the rolls. The beneficiaries of these results are the unit in which the rolls are manufactured, as well as the unit that exploits them. The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have a different influence upon the quality and the safety in the exploitation.

5. **CARMEN HĂRĂU**
THE ECONOMIC CRISIS AND THE SUSTAINABLE DEVELOPMENT

37

■ **Abstract:**

One of the constituents of the sustainable development is economic sustainability, along with the social, environmental and institutional dimensions. In business, there are only companies which manage their economic sustainability as no amount of excellent social and environmental performance will prolong the life of a company that is economically unsustainable.

It is only obvious that economies and communities are to a high degree affected by business failure and economic instability having a disastrous effect on people. However, businesses that only measure success against financial indicators, such as turnover and profit, increasingly risk failure. A broader perspective on sustainability is now emerging, based around reputation, full cost accounting, ability to add value and the management of knowledge.

Summarizing specific challenges, it is critically important that the European Union has resident (citizen) capacity to carry out strategic planning on a continuing basis. While this capacity will in the short-term necessarily have to depend on externally supplied expertise, more institutional strengthening will be required to ensure the development and institutionalization of planning and policymaking capacity at both national and state levels.

6. **IOAN BACIU, CORINA DANIELA CUNTAN, ANGELA IAGAR**
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■ **Abstract:**

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7. **CARMEN ALIC, CRISTINA MIKLOS, I. ZSOLT MIKLOS**
INTERACTIVE AND COLLABORATIVE LEARNING IN MECHANICAL ENGINEERING USING INTERNET

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■ **Abstract:**

In the process of preparing tomorrow's engineers and scientists, the universities are facing the challenge of gradually teaching students a reality of modern mechanical engineering, namely the mechanisms that occur from the interaction between different parts of complex technical systems. The use of Internet in the classroom offers the opportunity of efficiently adopting methodologies and advanced learning systems that can help the students to expand their views and explore new frontiers. This paper describes our experience concerning the possibility of using dedicated software (via Internet), for an interactive and collaborative learning in mechanical engineering.

8. **ADRIANA TOKAR, ION SPOREA, ARINA NEGOIȚESCU**
STUDIES AND TESTS CONCERNING SMELTING CASTING ALLOY OF UNIVERSAL ALUMINIUM

53

■ **Abstract:**

The direct consequence use on a major scale a silumin alloy type at casting pieces which working at high temperatures, e.g. thermal engine pistons, is: finding, smelting an alloy that possess good mechanical and technological properties, with preservation of those properties for a long time. The most recommended are Al-Si alloys type, allied with addition agent (Ea) such as Cu, Mg, Mn, B, Ti, Cr, etc. Large used alloys are $AlSi_9Cu_3MgB$ and $AlSi_{10}MgMn$ but with the shortcoming technology and mechanical properties, has been necessary to find a "universal" cast alloy that has proven to be $AlSi_9Cu_3MgMnB$, which is studied in this paper and responded well to the demands of constructors and technologists requirements of the non-ferrous foundries.

9. MARTIN FRIEDMANN, LUCIAN MOLDOVAN
CONSIDERATIONS REGARDING THE TESTING OF ELECTRICAL APPARATUS WITH THE TYPE OF PROTECTION "INCREASED SAFETY"

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■ **Abstract:**

Increased safety "e" represent a type of protection applied to electrical apparatus in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service or under specified abnormal conditions.

10. CRISTIAN P. CHIONCEL, DIETER KOHAKÉ, LADISLAV AUGUSTINOV,
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YIELD FACTORS OF A PHOTOVOLTAIC PLANT

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■ **Abstract:**

The paper gives the definition of the main yield factors that characterizes the performances of a photovoltaic plant. This are analyzed for a grid connected photovoltaic plant at the University in Resita, in use since spring 2008, were the main climatic and technique parameters of the photovoltaic plant are monitorised and heaped in an data base for further analysis.

11. ABDESSALEM LAMARI
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■ **Abstract:**

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12. Jiří ČUBAN, JAROSLAV KOVALČÍK
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75

■ **Abstract:**

This article presents comparisons of coated carbide cutting tool inserts used in machining of cylinder liners made of grey cast iron. The comparison has been realized through the tool life tests. The measurement has been carried out at three cutting speeds at constant cutting conditions. From the obtained values, the regression coefficients have been evaluated. Subsequently, extrapolation has been carried out by means of the regression line for the cutting speed in the range of 250 – 500 m/min, and for this the extended cutting speed range the interval reliability has been evaluated.

13. SORINA ŞERBAN
COMPUTER TRAINING IN CHEMISTRY: STRENGTHS AND WEAKNESSES

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■ **Abstract:**

Chemistry, as a subject of study, can not be taken into consideration without the computer science, especially nowadays. The issue of using computer in education has been deeply and multilateral researched in many countries, and the proposed solutions were determined, on the one hand, by the stage of education within that country, and, on the other hand, by the computerization degree of the society. Within the information society, the use of information and communication technologies in the educational system becomes a necessity. Interest in studying Chemical elements with the help of computer is determined by a number of cases to be presented in this paper.

14. SAMER KHOURI
OPTIMIZATION OF ENTERPRISE PROCESSES BY MEANS OF IMPLEMENTATION OF AN EFFICIENT ERP SYSTEM

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■ **Abstract:**

Optimal functioning of an enterprise in the present era of knowledge economy is related with the demand of efficiency increase in organizing, planning, control and outputs of flows beginning with development and purchase and ending by manufacturing and distribution according to

needs of customers so that all conditions of market by minimal costs and capital expenses, while maximizing income of the enterprise. These facts lead to the demand for a qualitative and efficient information system of the enterprise, which is at present becoming the key factor of success on the market. The enterprises that do not put their attention to inclusion of modern information technologies are getting themselves into strategic disadvantage compared to their competition.

15. V. RAJESH

MHD FREE CONVECTION FLOW PAST AN ACCELERATED VERTICAL POROUS PLATE WITH VARIABLE TEMPERATURE THROUGH A POROUS MEDIUM

91

■ **Abstract:**

The effect of a uniform transverse magnetic field on the free convection flow of an electrically-conducting fluid past an uniformly accelerated infinite, vertical, porous plate through a porous medium is discussed. The plate temperature is raised linearly with time. Expressions for the velocity field and skin friction are obtained by the Laplace transform technique. The influence of the various parameters, entering into the problem, on the velocity field and skin friction is extensively discussed with the help of graphs.

16. SONIA PETRILA, TITUS PETRILA

FLUID FLOW INDUCED BY A MOBILE PROFILE WITH NON-CONSTANT CIRCULATION

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■ **Abstract:**

This paper deals with an approach of the inviscid 2-dimensional fluid flow induced by the rototranslation of a profile (with a cuspidal point) in the fluid mass, by accepting a non-constant circulation $\Gamma(t)$ around the profile, i.e., multiformity for the pressure field. Some aerodynamic characteristics of a flow induced by an oscillatory motion of a Joukovski profile are calculated.

17. ANJAN KUMAR KUNDU, BIJOY BANDYOPADHYAY

AN IMAGE RECONSTRUCTION AND ENHANCEMENT TECHNIQUE FOR MICROWAVE TOMOGRAPHY

101

■ **Abstract:**

An inverse iterative algorithm for microwave imaging based on moment method solution is presented here. This algorithm is based on Levenberg-Marquardt method. Different mesh size of the model has been used here to overcome the inverse crime. The reconstructed image is then processed through different image enhancement tools.

18. SALAHALDEIN ALSADEY, ABDELNASER OMRAN, ABDUL HAMID KADIR PAKIR

DEFECTS IN THE LIBYAN CONSTRUCTION INDUSTRY: A CASE STUDY OF BANI WALID CITY

105

■ **Abstract:**

Defects in newly completed buildings are fast becoming serious phenomena as more low cost and medium cost houses are being built. One of the many approaches that have been utilized to alleviate defects is the introduction of the zero defects concept in construction. This research is undertaken to find out the level of awareness and perception of construction industry players about this concept, and whether zero defects or an aim towards achieving zero defects is attainable. A review of the relevant literature on the subject of defects and the zero defects concepts was executed, followed by a field research in the form of a questionnaire. The scope of this paper encompasses a study of defects in construction industry, and the concept and its application in the local construction scene in Libya. This paper has managed to ascertain that despite the unenthusiastic responses from members in the industry towards this concept in general, most industry players are optimistic that defects can be reduced if certain constructive measures are taken. In summary, the findings of this paper are suggested that absolute zero defects may not be attainable, in concurrence with the literature review earlier. However, if proactive steps are taken, the quest towards achieving zero defects can be obtained.

19. VERONICA A. KUMURUR

THE CITY DEVELOPMENT EFFECT ON WORK BURDEN OF WOMEN POOR IN JAKARTA

109

■ **Abstract:**

Development is done on the ecosystem of Jakarta generate increased economic growth with enough significant of years. However, economic growth cannot be enjoyed by the whole

community of Jakarta. Urban development not only generates economic growth and environmental degradation, such as air pollution, pollution of river water and ground water. Both of these constitute a social gap for the city of Jakarta. Where these gaps become a heavy burden for the poor city of Jakarta. Heaviness of the same was not felt by the poor men and poor women of Jakarta. Women, who have experienced poverty in the city of Jakarta, received a heavier burden than men. These burdens perceived internally and externally. Internal burden is the burden that is felt in the lives of female domestic shutter and external load is felt in the public shutter poor women. This burden is also due to women living in poverty will try to keep life in many ways. Poor women must work to maintain family life and her husband, though the choice is very limited work. Poor women are important actors in sustainable urban development through make community sustain. As a result of job choices, poor women are behind the effect and become input (input) for the balance of the ecosystem of Jakarta. If the input quality of the ecosystem conditions will lead to a balanced process that ultimately sustainable. This sustainability will be transmitted to the sustainability of ecosystems nationally, regionally and globally.

20. RENY SYAFRINY, T. SANGKERTADI

THE CITY DEVELOPMENT EFFECT ON WORK BURDEN OF WOMEN POOR IN JAKARTA

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■ **Abstract:**

In many cases, public open spaces in the cities have been designed and modified in very short-term goals, under the consideration of local situation. The style of public open space design has evolved in recent years to promote a more environmentally -friendly method of enjoying our outdoor property. As an enjoyable place in the cities, open space design should begin with an understanding of the future use of the property, and the proper design will be unique to a specific site and should be based on a careful review process. Objectives of the research is to develop a method of design review for outdoor space, by using Post Occupancy Evaluation (POE) method, which has been mostly applied in a single building or simple setting only. POE is a process of evaluation concerning the effectiveness of spatial design creation and its fixtures after the construction and operational function. The evaluation took place in some public open space in Manado which had most population in the cities. Research focused on 3 elements of space performances: technical, functional and behavioral aspects. The result shows that, technically, design performance of space could successfully bring pleasant for the visitor. Although its functions are very limited, the quality of environment is poor because of the thermal comfort and cleanliness problems.

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ACTA TECHNICA CORVINIENSIS – Bulletin of Engineering is an international and interdisciplinary journal which reports on scientific and technical contributions.

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CLASSIFICATION OF TOOTH GEAR WHEEL FAULTS OF GEARBOX WORKING IN THE CIRCULATING POWER TEST RIG BY MULTILAYER PERCEPTRON AND CONTINUOUS WAVELET TRANSFORM

Abstract:

In the article the results of the attempts are presented to build a classifier of the local teeth damages in gear wheels, based on artificial neural networks. In the tests the neural networks of a multilayer perceptron type (MLP) were used. The research object was a toothed gear with straight teeth, working on a rotating power stand FZG. Both the undamaged gears and gears with local teeth damages in the form of crack in the tooth base and the crumbling of a tooth tip were tested. In the article, it is suggested to build a descriptor of wheel teeth local damages with the use of vibration signals which were properly filtered and processed.

Keywords:

gearbox, diagnosis, neural networks

INTRODUCTION

Monitoring and diagnosing the state of technical objects is one of the basic actions in the construction of a strategy for their proper exploitation. Very often, when a failure occurs, not only is it connected with economic loss, but also with danger to human life. It is necessary, then, to create the proper diagnostic tools enabling the early detection of all the threats. The tests conducted for many years, both in national and foreign research laboratories, are aimed at creating proper tools, helpful in the recognition process of the power transmission system damages [1-6,8-11,13-15,17]. Currently, all over the world, methods are developed to enable the diagnosis of the condition of the drive transfer system elements without the need of their disassembly.

Among such methods we find the vibroacoustic method, where the sources of information about the object condition are the vibrations and/or noise emitted by it. Literature points at huge possibilities of vibroacoustic signals use in the diagnostic process and their proper filtration, preliminary processing and analysis allow getting information about the object condition. Novelty described in literature is an expert system which uses the artificial intelligence elements [5-9,12-14,16]. Properly constructed and taught system can automatically recognise the occurring defects.

RESEARCH OBJECT

The research object was a toothed gear working in the power transmission system, which consisted of an electric engine, belt transmission,

tested toothed gear, closing gear and stretching clutch. The electric engine with a power of 15 [kW] with the use of belt transmission powered the closing gear. The gear load was regulated by the levers with weights, stretching clutch and torsional shafts. The work speed of the gear was set with the use of frequency converter steering the work of the electric engine. The tested gear and the closing gear had the same transmission ratio and the same wheel base.

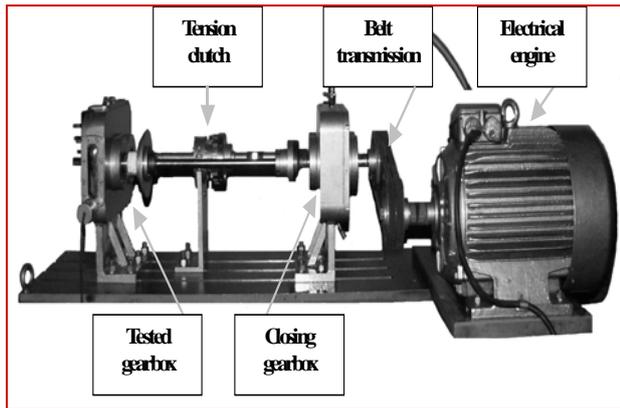


Fig. 1 Scheme of the circulating power test rig

In fig.1 the tested toothed gear is presented working in the rotating power system. The toothed gear with straight teeth was tested, where the number of teeth in the pinion and the wheel equalled 16 and 24 respectively. In the tests the toothed wheels made of 20H2N4A were used, which were carburized and hardened to the hardness equalling 60-62 HRC.

THE EXPERIMENT DESCRIPTION

The aim of the experiment was an attempt to classify the type and stage of teeth damages in gear wheels with the use of artificial neural networks [5-9,12-14,16]. In the experiments it was decided to use the diagnostic information about the object condition included in the vibration signal. On the basis of literature [2-6,9-11,13-15,17] the signal assumed as the information carrier correctly reflecting the damages of toothed gear was the transverse vibration speed signal of the wheel shaft. The measures were taken in the direction of inter-teeth force interaction. The measurement system consisted of angular position sensors of shafts, a logic unit, a laser vibrometer, the signal analyser and a computer. The measurement of the transverse vibrations of the gear wheel was conducted with the use of

laser vibrometer Ometron VH300+. The logic unit with two angular position sensors of shafts enabled the precise definition of the connection moment of the same pair of teeth. The registered vibration speed signal and the reference signal from the logic unit were processed in the signal analyser DSPT SigLab. The measured signals were sampled with frequency of 25600 [Hz] and registered on a PC computer.

In order to check the functioning correctness of the neural classifiers in the task of defect stage identification of the toothed gear, a series of transverse vibrations measurements was conducted of the wheel shaft in an undamaged gear and in a gear with modelled damages:

- cracks at the tooth base (1 and 3 [mm]),
- crumblings on the tooth tip (0,75 and 1,5 and 2 [mm]).

The measurements were conducted for a toothed gear working at two rotational speeds of the wheel shaft (900 and 1800[obr/min]) and with two loads (138 and 206 [Nm]).

The result of the conducted process of signal registration was the achievement of the matrix consisting of 971 transverse vibrations speed signals of the wheel shaft.

The vibration signals registered on FZG stand were put under the influence of five filters. Filters number 1 and 2 were low-pass filters with the range of 6 and 12 kHz. Next filters enabled getting the residual signals (filter number 3) and the differential signals (filter number 4). The last filter enabled getting the signal of meshing frequency range from 0.5-1.5 [5,6,9-11].

Signal in time domain, known as residual signal was achieved by the removal from the spectrum of bands including the rotational constituents of the wheel shafts and their harmonics and the constituents of the meshing frequencies and their harmonics, and next by the use of the inverse Fourier transform. The differential signal was achieved similarly to the residual signal, but in this case the removed bands around the meshing frequency and their harmonics were wider and included the sidebands connected with the rotational frequencies of the toothed wheels.

In the next stage of tooth damage models creation the vibration signals achieved with the use of five filters were put under the influence of continuous wavelet transform (CWT) [1,4-6,8,13,15].

In the next stage of tooth damage models creation the vibration signals achieved with the use of five filters were put under the influence of continuous wavelet transform (CWT).

Wavelet analysis consists of signal decomposition and presenting it in the form of linear combination of basic functions, called wavelets. The feature which distinguishes this method of signal analysis from other methods is the multi-stage signal decomposition, variable resolution in time and frequency domain and possibility to use basic functions other than harmonic functions. Continuous wavelet transform is defined as follows:

$$\text{CWT}(a, b) = \frac{1}{\sqrt{a}} \int_{-\infty}^{+\infty} \psi\left(\frac{t-b}{a}\right) \cdot x(t) dt \quad (1)$$

where:

$\psi_{a,b}(t)$ – the analyzing wavelet,

a – the scale parameter, $a \in R^+$, $a \neq 0$,

b – the time parameter, $b \in R$.

Wavelet frequency is regulated by the parameter of scale a , whereas using parameter b one can test the local properties of the time runs.

This method, due to the possibility of adjustment of the window width to the analysed frequency range enables testing the non-stationary signals. For the long-term variation runs the window expands in time domain, whereas with high frequencies it narrows preserving a constant surface area. The authors in paper [8] states that the proper choice of the basic wavelet and the array of the scale value determine the correctness of the diagnosis process of the object technical condition with the use of wavelet analysis.

In the preliminary test the usefulness of 83 basic wavelets was checked, which belonged to series: haar, daubechies, biorthogonal, coiflets, symlets, morlet, mexican hat, meyer, reverse biorthogonal, gaussian, complex gaussian, shannon, frequency b-spline, complex morlet, discrete approximation of meyer.

In order to describe the change character of the signal amplitude under the influence of CWT for 20 scale analyses, chosen in preliminary stage, a measure was marked. This measure described the change course of the amplitude CWT distribution in time domain. In the tests the usefulness of 35 diagnostic measures commonly used in literature was checked (variation coefficient, peak coefficient, clearance

coefficient, shape coefficient, impulsing and asymmetry coefficient, quarter and average deviation; arithmetic, geometric and harmonic averages; quartiles, non-dimensional discriminants, central moments, cumulants, signal energy, efficiency values, inter-peak values, maximum and minimum, variance, positional variation coefficient) [5,6].

As a result of tests 14525 sets of models were built. Each set of models had the size of 971x20. This size reflected the number of cases (number of measured on FZG stand vibration signals) and the number of network inputs (number of scales, in which the measure was marked). Each option of model sets was divided into halves and in this way teaching and testing data were achieved.

In preliminary investigations were chosen following wavelets [5,6]:

- Daubechies Wavelet 9 (wavelet no. = 9),
- Morlet Wavelet (wavelet no. = 37),
- Reverse Biorthogonal Wavelet 3.7 (wavelet no. = 50),

and estimators [5,6]:

- impulse ratio (estimator no. = 5),
- root mean square (estimator no. = 14),
- value of range between maximum and minimum (estimator no. = 25).

In the tests performed in order to build a diagnostic classifier the artificial neural networks of multilayer perceptron type (MLP) were used.

In case of application of such neural networks, one needs to define the architecture, the method of network teaching and the type of neurons used in hidden layers of the network [7,12,16]. It should be remembered, however, that the stages should not be divided, because they are directly connected. At the same time literature shows the lack of rules connected with the choice of the parameters and points out the necessity of their setting with the use of experimental method – trial and-error method [7,12,16].

In the conducted experiments for each set of models the best option of network architecture was chosen. By the selection of network architecture the usefulness of classifiers build of one and of two hidden layers was checked. On the basis of preliminary tests [5,6] it was assumed that for each hidden layer there is a possibility of existing of 5, 10, 15, 20, 25 and 30 neurons. Simultaneously, an attempt was made to check, if for an analysed diagnostic task an optimum architecture can be defined, independently from the way models are built.

Next element, which was supposed to be defined, was the kind of the applied teaching method. By its choice one should take into account both the criterion of the error value, as well as the time requirements needed for network teaching. At the same time it should be noticed that the efficiency of the teaching methods is dependent on: the particular task, the number of the accessible models and the network architecture. That is why it is not possible to decide a priori, which method is the most efficient one. In the tests it was decided to check the usefulness of different network teaching methods (Table 1).

Tab. 1: MLP network teaching methods.

No	Name of algorithm
1	Gradient descent backpropagation
2	Gradient descent with momentum backpropagation
3	Gradient descent with momentum and adaptive learning rate backpropagation
4	Resilient backpropagation
5	Conjugate gradient backpropagation with Fletcher-Reeves updates
6	Conjugate gradient backpropagation with Polak-Ribiere updates
7	Conjugate gradient backpropagation with Powell-Beale restarts
8	Scaled conjugate gradient backpropagation
9	One step secant backpropagation
10	BFGS quasi-Newton backpropagation
11	Levenberg-Marquardt backpropagation
12	Bayesian regularization backpropagation

It was checked what influence the applied algorithm of network teaching has on the correctness of the achieved results.

In each of the experiments two types of neurons used in hidden layers were checked. For the tests sigma neurons and tangent curve type neurons were chosen [7,12,16].

THE RESULTS OF THE EXPERIMENT

In the first trials it was decided to build an artificial neural network capable of recognition of the following classes of damages:

- an undamaged gear,
- a gear with a tooth cracked at its base,
- a gear with a crumbled tooth.

Tests with the use of MLP type classifiers taught with the use of data gathered in CWT analysis led to construction of classifiers characterised by the error-free diagnosis of the damage type in a toothed gear. Independently from the neuron types used in the hidden layers of the MLP

network, the lowest classification error values were achieved in case of application of the effective value (number of measure = 14) to the description of change character in the CWT distribution. The highest error values of classifiers diagnosing the type of gear teeth damages were achieved with the use of methods number 1, 2, and 3 in the teaching process (Table 1).

Because it was possible to build a classifier, which could faultlessly assess the type of the existing teeth damage of the gear wheels, it was decided to proceed to the research target in further experiments, that is to the task of checking the MLP network usefulness in the classification process of teeth damage type and advancement in gear wheels. In the conducted tests the neural network of MLP type was taught to identify the following classes:

- no damages,
- crack at the tooth base at a depth of 1 [mm],
- crack at the tooth base at a depth of 3 [mm],
- 0,75 [mm] crumbling of the tooth tip,
- 1,5 [mm] crumbling of the tooth tip,
- 2 [mm] crumbling of the tooth tip.

The results of the conducted experiments aiming at the choice of optimum architecture of MLP network showed the relationships resulting from the extension of the number of neurons. Some cases were noticed, where with the rise of the neurons number in first hidden layer, the error initially drops and then rises. It occurs due to the fact that the network was over-taught and lost the ability to generalise. Such situations are also visible, where the increase in the number of hidden layers with the appropriately big number of neurons improves the efficiency of the classification.

On the basis of the achieved results one can notice, that independently from the used teaching algorithm of a network, type of neurons applied in hidden layers and the chosen basic wavelet, the lowest testing error level appeared in case of classifiers taught on data achieved from the CWT distribution characterised with the use of effective value (measure number = 14). The highest testing error level was visible with the use of inter-peak value (measure number = 25).

It can be noticed during the analysis of the classification results with regard to the filtration method of the vibration signal used during models creation that independently from the

used algorithm of network teaching, the types of neurons applied in hidden layers and the chosen basic wavelet the least precise classifiers were created on the basis of the residual signals and the differential signals (filter number 3 and 4). Neural networks taught with the use of gradient method showed big sensitivity to the neurons type used in hidden layers. By application of models created in the same way in the teaching process, the classifiers built of tangent neurons distinguished themselves with a far better level of results consistence with the model, than the classifiers built of sigma neurons. Such dependence did not occur in case of networks taught with the use of Levenberg-Marquardt method.

CONCLUSIONS

As a result of the conducted research it was possible to build a correctly working classifier of both the kind, as well as the kind and advancement of the gear damage.

On the basis of the conducted research one can notice, that a significant influence on the achieved classification error is exerted both by the way of damage models preparation (filtration method, type of applied basic wavelet, applied measure) and by the architecture and the artificial neural network teaching method.

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INJECTION MOLDED BIODEGRADABLE POLYMER STUDY

■ Abstract:

This paper is next of the papers series which is biodegradable plastics properties considering. Concretely biopolymer HL103 was chosen for this series. Biologic degradation was realized in nature compost and acid and alkaline solution. Mechanical properties change was observed in dependence on time after production. Testing specimen production was realized by injection molding.

■ Keywords:

biodegradable, plastics, mechanical, tests

■ INTRODUCTION

The world most used plastics PE and PP biodegradability improving modification is searched due to their large produced volume. It is not easy to find right PE or PP modification which is acceptable with regard to ecologic site. Some PE and PP applications – concretely various packaging application is possible to substitute not with modified PE or PP but with entirely different materials – fully biodegradable plastics. Behavior knowledge of these materials is necessary to successful using these materials. Fully biodegradability of all material components is the basic advantage comparing to conventional petrolic polymers.

For this study was proposed experiment which should simulate concrete conditions of plastic parts using. Biodegradable polymer behavior during this conditions (which are described below) is observed in dependence to time after production.

Experiment is using for observation normalized testing specimens which were produced by normalized molds with injection molding on conventional molding machine – ENGEL VICTORY 80/25.

Observation is based on next mechanical properties tests:

- tensile test (ČSN EN ISO 527-1,2,
 - flexural test (ČSN EN ISO 178),
 - impact IZOD test (ČSN EN ISO 180),
 - Shore D hardness test (ČSN EN ISO 868)
- [1][2][3][4]

and specimens (see fig. 1) surface analysis.

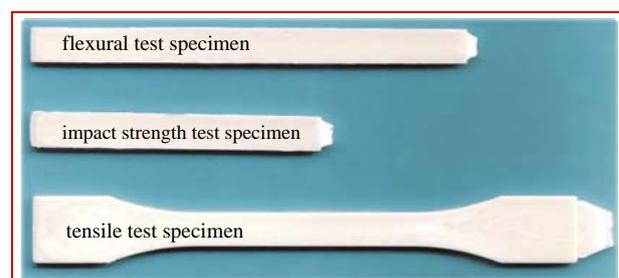


Fig. 1 Mechanical properties test specimens

Mechanical properties as same as surface appearance are observed 1st, 10th, 20th, 30th, 40th, 50th and 60th day after production.

Specimens (see fig. 1) are immediately after production placed to four another areas which should simulate real plastics using conditions. The first area is water solution with neutral pH (7±0,2), second area is water solution with acidic

pH ($2\pm 0,2$) third area is water solution with alcalic pH ($11\pm 0,2$) and fourth is area of natural compost with compost activator based on bacteria and enzyme combination (biocatalyst) improving biodegradation. pH of water solution was periodically measured with ACIDIMETR 333 and possible changes of pH was regulated that pH was constant during experiment in interval $\pm 0,2$ from nominal value.

Scheme of whole experiment is shown below:

SPECIMEN PRODUCTION → IMMEDIATELY PLACING SPECIMENS TO CHOSEN AREAS

- after 1 day – mechanical properties tests, surface analysis
- after 10 days - mechanical properties tests, surface analysis
- ...
- after 60 days - mechanical properties tests, surface analysis

THE RESULTS

The flexural modulus made the biggest mechanical properties change as specimens were longer in each area. This is probably caused of high sensitivity of this mechanical property to property of skin part of specimen which is the first degraded part of the specimen. Fig. 2 shows flexural modulus dependence on time by each area specimen placement.

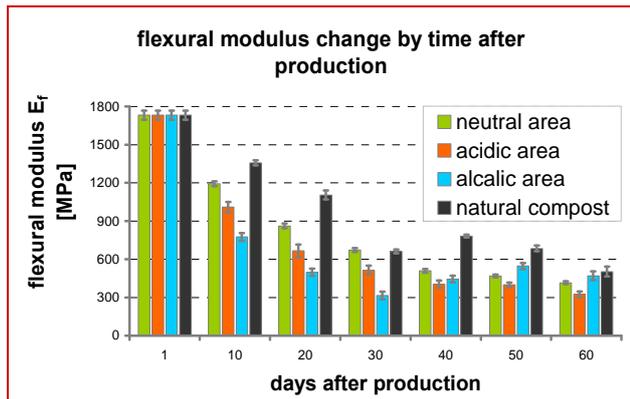


Fig. 2 Flexural modulus results

Same reason of flexural modulus change caused relatively high decrease of flexural strength as shown on fig. 3.

In the opposite of mentioned above, some mechanical properties did not make significant change. The first of them is tensile strength as is shown on fig. 4.

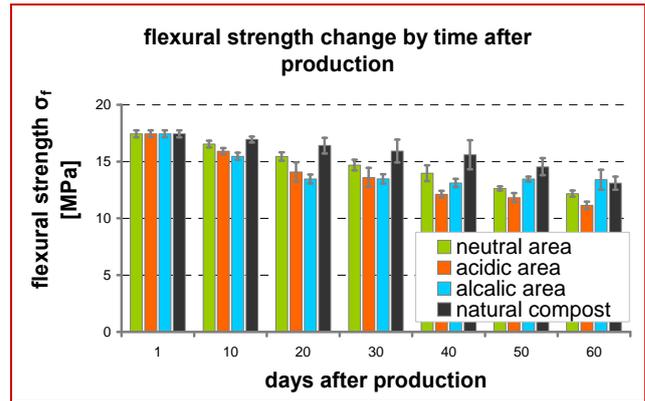


Fig. 3 Flexural strength results

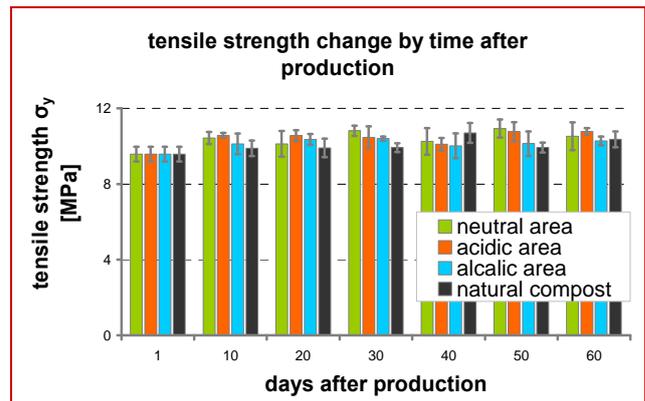


Fig. 4 Tensile strength results

Flexural strength values are virtually without some change regardless area, where is just specimen placed. Second property which is not sensitive to placement in biodegradable area (in chosen time interval) is SHORE D hardness. Is possible to say that changes in this case are in statistical deviation. See fig. 5. Light change was observed in case of IZOD impact strength. This dependence is shown on fig. 7.

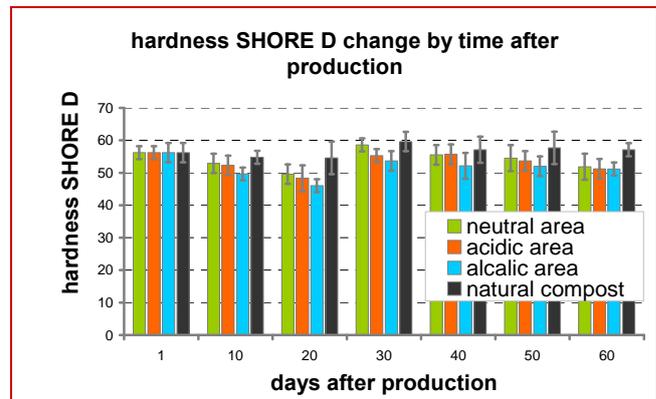


Fig. 5 Hardness SHORE D results

During whole experiment was also specimen surface analyzed. In case of water solution was observed same changes with increasing time after production in each area regardless water

pH. These changes of surface are shown on fig. 7, fig. 8., fig 9 and fig. 10.

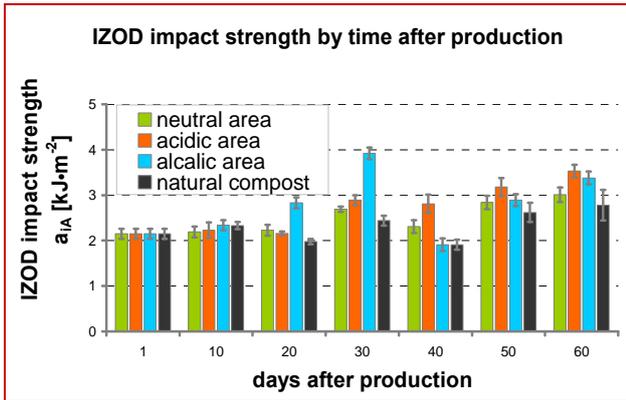


Fig. 6 Hardness SHORE D results

For better clearness were fig. 7 and fig 9. graphically exposed a color saturated. Result of this graphic changes sharpening is fig. 8 (based on fig. 7) and fig. 10 (based on fig. 9). Specimen surface placed in water solution (neutral/acidic/alcalic) is by time after production turning to light. Final surface after 60 days is absolutely white. This is caused by gradual starch separation. After 30 days period was also observed surface change to surface similar to chalk surface. Fig. 11 shows gradual specimen degradation in nature compost. Surface changes in this case are obvious.

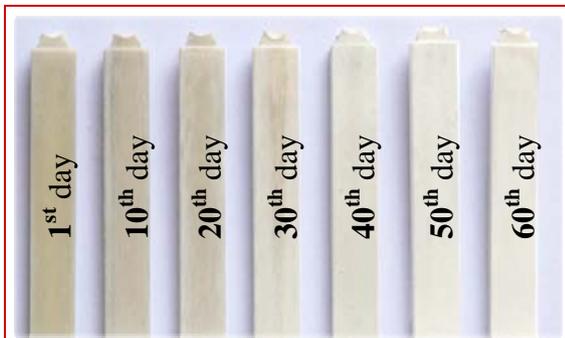


Fig. 7 Specimens biodegradation in ACIDIC/ALCALIC area.

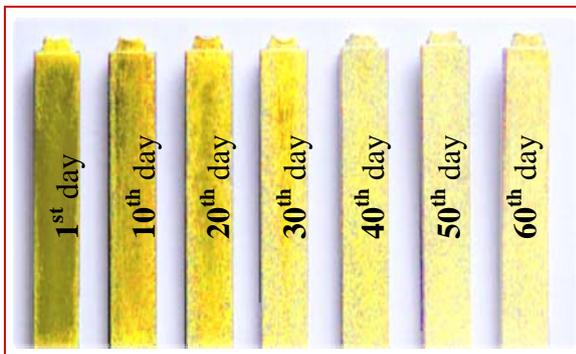


Fig. 8 Specimens biodegradation in ACIDIC/ALCALIC area – graphically exposed

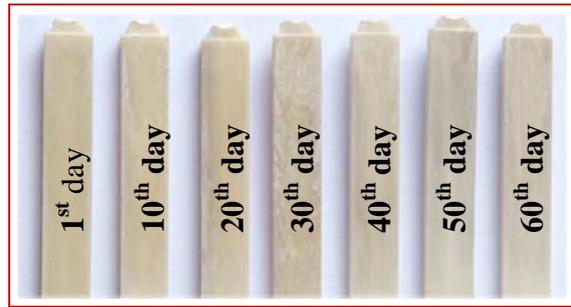


Fig. 9 Specimens biodegradation in NEUTRAL area

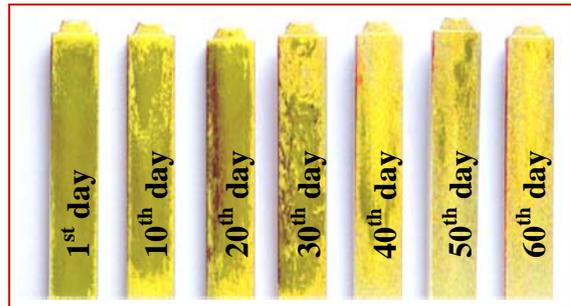


Fig. 10 Specimens biodegradation in NEUTRAL area - graphically exposed

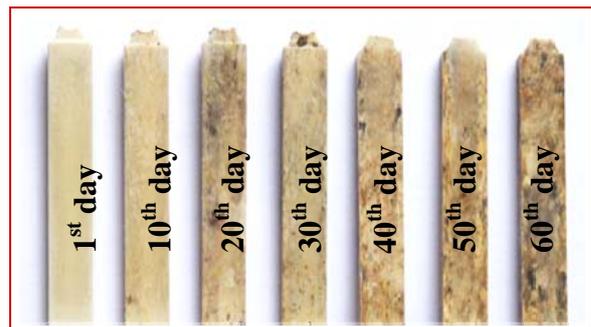


Fig. 11 Specimens biodegradation in NATURE COMPOST

CONCLUSIONS

Getting knowledge of behavior biodegradable plastic PSM HL 103 in different areas is main goal of this paper. Just this knowledge is important to material selection during plastic part proposal or construction. Is obvious that exists plastic parts where is acceptable significant flexural modulus and flexural strength change without any significant change of tensile properties, hardness or light impact strength as same as probably exists parts, where this is not acceptable. Is necessary to remind, that mentioned dependences are valid for mentioned 60 days period after specimen / part production. Probable application of observed biodegradable material as same as of all fully biodegradable materials is application where is plastic part life cycle very short. As mentioned above it is the

most probably application in packaging field, where goods are using (are performing function) only for some days and after it is problem "WHAT WITH THEM"? This problem in case of PE and PP materials is very complicated and never could not be absolutely solved. Biodegradable plastics advantage in this case is obvious. Due to their comfortable (for unpretentious applications as packaging etc.) properties can perform plastic part function without any problem and after end of part life cycle (where conventional petrolic polymers becomes problem) is able to resolve to nature component without any "ecologic print". In next studies will be observed technological parameters influence to degradation behavior of the material HL-103. Because of relatively high price of this material, next studies will be also focused to price decreasing possibilities. The simplest way is to fill this basic material with another biodegradable material which is much cheaper than basic polymeric material. For example it could be wood powder. It is question, how can this filler affect mechanical properties and properties during biodegradation. Probably wood powder will decrease mechanical properties of specimen made of compound HL-103 and wood powder, but on other side will be decreased time of complete degradation. Rate of these influences is of course in volume percentage of added wood powder. And this is the question will be solved in next studies, where will be used various wood powder percentages in basic HL-103 and similar properties observed in this study will be observed for each compound.

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ANALYSIS OF ENGINEERING MATERIALS SCIENCE FOR ADVANCES IN DESIGN FOR MANUFACTURING PROCESSES

■ **Abstract:**

This paper described role of materials selection for the design and manufacturing processes of new, needed products, having the highest attainable quality and performance at the optimum and reasonably set - possibly lowest cost level. The review of the long history of human civilisation indicates that the significant increase of the level of living and production is connected most often with introduction of new material groups, having their properties adjusted better and better to the real customers requirements that get more sophisticated nearly each day, and having also the technological processes relevant to them. The reasons given, make it possible to forecast that the future of the market and products on it, with the required properties, are inseparably connected with the development of Engineering Materials.

■ **Keywords:**

design, engineering materials, production process, product

■ **INTRODUCTION**

Modern products could not be often designed and manufactured without employing many materials, just as that they could not operate in required service conditions and with the required very high reliability. One has to realise that the contemporary product is composed of a host of elements made from materials varying a great deal. As an example, the average car is composed of about 15,000 elements, whereas the passenger aircraft has more than 4,000,000 elements. Many people, even today, do their work at home, without leaving it. Houses will have to be organised and furnished in a totally other way within several years' time span. Towns, transportation and telecom systems will be organised differently than nowadays. Towns

and transport system will be organised in another way, including novel urban transportation systems connecting the sky-high buildings, electrically powered cars, robotized safety systems and municipal wastes utilisation systems. Health care system will be based on diagnoses made at home, non-allergic nutrition, early detection of serious illnesses and their prevention, and also on implanting of artificial organs-heart, and of a new generation of biomaterials. Future agriculture, forestry and fish industry will be based on genetic engineering achievements, mastering fanning new plants, employing other processes than photosynthesis, and also comprehensive robotisation. Mining and manufacturing industries will be based on a total robotisation of processes of industrial

(prepared according defined by their physical, to [2], [9]) mechanical, thermal, electrical, magnetic, and optical properties. These properties depend on structure and chemical composition of the material and on service conditions of the element. The aim of materials science is to investigate the effect of their structure in various scales (electron, crystalline, micro, and macro) on materials properties. The numerous grades of the actually available materials yield new innovative potential in implementation of products. Determining the relationships among structure, techno-logical process, and functional properties, and also the selection of materials and technological processes forming their structure and properties for use in complex manufacturing systems, feature the main focus of materials engineering. The vast majority of engineering materials are derived from raw materials obtained from the crust of the earth, raised in mines as ores and then enriched to make possible their extraction or synthesis. Figure 4 illustrates the relation of strength and the specific energy consumption of materials (defined as the product of energy required to make (the material, i.e., obtaining the raw materials, their refining, and shaping of the produced material, related to 1 kg of the material, and its density). This coefficient expresses indirectly the influence of the material manufacturing process on degradation of the environment. The specific energy consumption shows linear dependence with the material strength. The situation as it is now and current forecasts require from engineers the coordinated activities aimed at saving the available raw materials, consisting in:

- designing with the economical use of materials, mostly those hardly available and close to be depleted, with minimum of their energy consumption,
- using easier to acquire alternatives with the large margin of the half-life of their raw materials depletion and with lower energy consumption, instead of those hardly available and close to be depleted,
- making full use of the energy saving recycling for their reuse and full recovery of materials in all possible and economically justified cases.

The selection of the proper material along with the appropriate technological process is vital, as it ensures the longest product life with the

lowest costs, considering that one has to account for more than 100,000 engineering materials possible and available on the market, and yet, the average engineer has a detailed knowledge about the practical applications of some 50-100 engineering materials. Because of the significantly diversified conditions of use of various products, and also their diversified design features, collecting many detailed information is required for proper material selection. Two approaches are possible to the selection of combinations of materials and the technological process of the particular element. First, one may select either the material, which is more frequently preferred by engineers, or the techno-logical process, whose consequence is selection of the technological process or materials respectively in the second move.

■ **GENERAL BASES OF PRODUCTS DESIGNING FOR PREPARING THEIR PRODUCTION PROCESSES**

Manufacturing is the process of transforming of raw materials into products. Manufacturing consists in making products from the raw materials in various processes, using various machines and in operations organised according to the well-prepared plan. Therefore, the manufacturing process consists in a proper use of resources like: materials, energy, capital, and people. Nowadays, manufacturing is a complex activity merging people working in various professions and carrying out miscellaneous jobs using diverse machines, equipment, and tools, automated to a various extent, including computers and robots. The technical aspect of this effort pertains to the engineering design of a product. Engineering design of a product is to merge in itself three equally important and indivisible elements, Fig.3:

- structural design, whose goal is to work out the shape and geometrical features of products satisfying human needs,
- materials design for the selection the required physical and chemical, as well as technological properties, ensuring the expected life of the product or its elements, and the
- technological design making it possible to impose the required geometrical features and properties to the particular product elements, and also to ensure their correct mating after assembly, accounting for the

production volume, its automation level and computer assistance, and also with ensuring the lowest possible costs of the product.

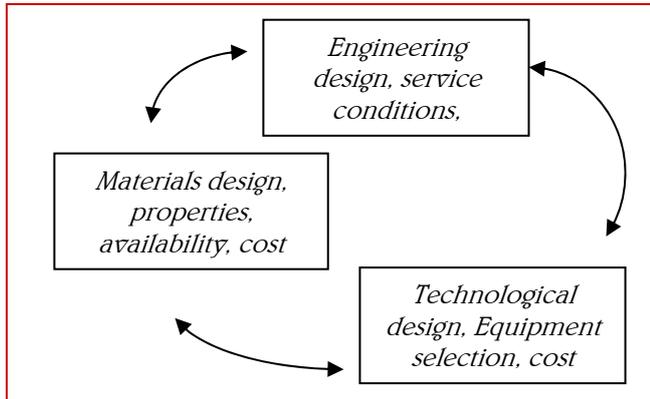


Fig.3. Engineering design of a product

Engineering design is connected with determining the shape of the product and its elements, selection of materials from which they are to be made, and the selection of the relevant technological processes. The designed product has to meet the parameters pertaining fully to its functionality, and also requirements connected with its shape and dimensional tolerances; moreover, the design has to include the list of materials used, manufacturing methods, and other necessary information. One has to account for, among other, consequences and risk of product failure, resulting from its foreseen, however probable misuse, or the imperfection of the manufacturing process. Possible consequences of product failure affect the evaluation of the significance of its assumed reliability. Economical aspects do not impose excessively demanding reliability requirements if there is no risk of injuries or incurring losses due to product failure in use, Fig.4. Each product shape version imposes some requirements pertaining to the material properties that can meet them, to which one may include the relationships between stresses resulting from the product shape and its load, and the material strength. The change of the manufacturing process may change the material properties, and some product-material combinations may be infeasible using some technological processes. Relationships between product shape requirements and material properties may be evaluated using the deterministic or stochastic methods. In the deterministic methods one uses the nominal or average stress, dimension, and strength values for calculations, moreover, the

relevant factors of safety are used, whose task is to account for the expected variability of these design parameters.

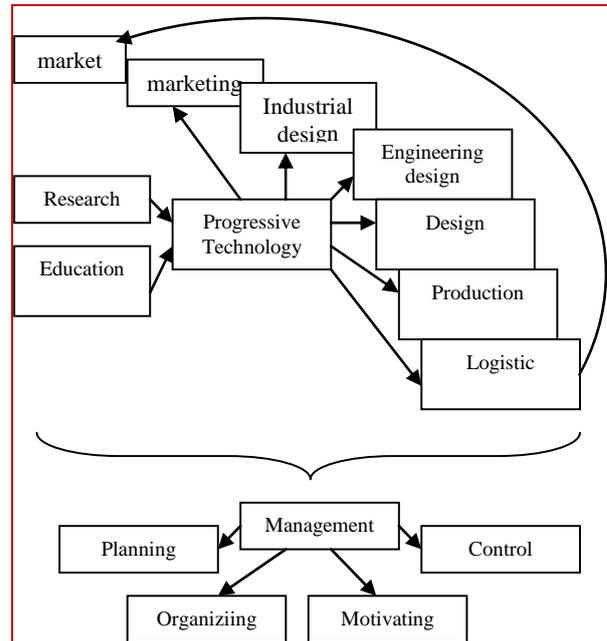


Fig.4. Design of the product is located between its marketing and manufacturing in the process of its introducing into the market

The reasons of some 90% failures caused by material fatigue in service are connected with the faulty design and manufacturing faults, and only 10% result from material faults, its improper chemical composition or heat treatment errors. Even the seemingly insignificant reasons may result in serious consequences. In one case, for instance, the fatigue damage of the aircraft in flight was caused by the inspection stamp that was imprinted too heavily on one of its elements. The failure modes that might directly endanger life or limb or else damage or destroy products or their elements should not be allowed. The experimental verification enables to check the computer simulation in various scales and using the artificial intelligence methods, for employing the new materials and their manufacturing processes. The Computer Aided Materials Selection Systems (CAMS) and the Computer Aided Materials Design ones (CAMD) have found their right position within the framework of the Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) systems. Progress in this area is particularly important as the computer systems made available eliminate the gross errors made not infrequently using the traditional methods, and also feature the indispensable elements of

the computer aided design/ manufacturing/ material selection systems – CA-X.

■ **STRATEGIC DIRECTIONS OF ACTIVITIES OF THE FUTURE IN THE AREA OF MATERIALS SCIENCE AND ENGINEERING AS THE BASIS OF DESIGN AND MANUFACTURING OF THE NEW DEVELOPED PRODUCTS**

The process of implementing the new materials is connected with improving the existing materials or with taking into account the contemporary achievements connected with working out of the new compounds, structure, and ensuring the new properties. The fundamental feature is the possibility of designing the new materials focused on their small scale, inclusive the nanometric one, the optimisation of their applications, and also the optimisation of their manufacturing, including modelling of properties and processes. The modern theory of materials science and modelling specific for the computational materials science, are used for development of new materials. Introduction of new materials and improvement of the properties of materials manufactured to date call also for working out and implementing the new synthesis and processing methods. One should estimate, in particular, that the further progress of civilisation connected with introducing new products with the required high functional properties, will be to a great extent dependent on development of the engineering materials, making it possible to use them in engineering design of many new products expected on the market, encompassing, among others:

- *development of modelling the relationships among chemical composition, structure, parameters of the technological processes, and service conditions of the engineering materials,*
- *development of the pro-ecological manufacturing technologies with the possible lowest harmful environmental impact and/or influencing the environment and atmosphere,*
- *development of surface engineering and related technologies in order to increase significantly the competitiveness of products and technological processes,*
- *development and deployment of the industrial applications of the „smart” materials and*

automatically supervised technological processes,

- *development of manufacturing technologies making it possible employing the existing high-temperature superconductors in market products,*
- *introduction of the new heat resistant and high-temperature creep resisting materials for service at elevated and high temperatures, especially for the space,*
- *development of the composite materials and others obtained using other non-conventional technologies,*
- *introduction of new generations of biomaterials and biomimetic materials that will render it possible to extend the range of possible medical interventions and implanting the artificial organs and limbs to improve the level of treatment of diseases and injuries.*

■ **CONCLUSIONS**

Materials connected issues play surely an important role in carrying out these tasks of the engineers' circles, deciding thus directly the development potential of their societies. Integration of the advanced design and manufacturing processes of the state-of-the-art products and consumer goods features an important determinant of this development, encompassing the progress in the area of the design methodology and new designs created using the computer assisted technique methods (CAD). One should add to that development of new technologies and manufacturing processes, of the technological design methodology of modern manufacturing organization and operational management along with the computer assisted manufacturing (CAM), and also development of the materials design methodology, working out the completely new engineering materials with the required - better and better-functional properties, with the pro-ecological features and minimised energy consumption, along with the development of the computerised materials science and the computer assisted materials design methodology (CAMD). This integration is expressed best in the computer integrated manufacturing (CIM). Among the all main development trends of the advanced design and manufacturing processes of the novel advanced products in the forthcoming decades of the 21st century, one can

single out the importance of materials science and engineering, boiling down to materials design connected with adjusting the materials, starting from their chemical composition, constituent phases and micro-structure, to the set of properties required to use them in the final products, computational materials science as the indispensable materials' properties and manufacturing processes affecting them prediction tool, advanced analytical techniques employed in investigation and synthesis of materials to their nanocrystalline and atomic scales inclusive, techniques of the future for manufacturing the engineering materials composed of atoms and molecules, and development of nanomaterials, smart materials and the biomimetic ones. The essential challenges facing the academic circles in the area of the advanced design and manufacturing processes of the novel advanced products and consumer goods call for convincing the world of industry, management, and politics about the need of investing in science for acquiring the contemporary technological progress. It is important that the time span between the scientific discoveries and their practical applications is made as short as possible, and that the societies are convinced that there exist links between the current fundamental research and future welfare.

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INCREASING THE ROLLING-MILL ROLLS QUALITY - IN SOME MULTIDISCIPLINARY RESEARCH

■ **Abstract:**

Quality assurance is the activity of providing evidence needed to establish quality in work, and that activities that require good quality are being performed effectively. All those planned or systematic actions necessary to provide enough confidence that a product or service will satisfy the given requirements for quality. Quality assurance covers all activities from design, development, production, installation, servicing and documentation. It includes the regulation of the quality of raw materials, assemblies, products and components, services related to production, and management, production, and inspection processes.

Our approaches the issue of quality assurance of the rolling mills rolls, from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation. The experimented durability research, as well as the optimization of the manufacturing technology, allows the conclusion of direct results for the rolls. The beneficiaries of these results are the unit in which the rolls are manufactured, as well as the unit that exploits them. The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have a different influence upon the quality and the safety in the exploitation.

■ **Keywords:**

quality assurance, cast-iron rolls, manufacturing, laboratory research, mathematical modeling

■ **INTRODUCTORY NOTES**

Roll makers always ask about rolling conditions and the necessity to choose the right grade of roll material and roll users always ask about the mechanical and physical properties of roll material. Sometimes they feed these figures into their rolling model, but sometimes they also need them for unknown reasons. This information is very rarely useful for selecting the right supplier. Roll makers and roll users frequently have to discuss experiences, performance results, and special requirements of the mill. Roll failure problems can be solved by good co-operation. In engineering and manufacturing, quality control and quality engineering are involved in developing systems to ensure products or services are designed and

produced to meet or exceed customer requirements. These systems are often developed in conjunction with other business and engineering disciplines using a cross-functional approach. By collecting data from samples at various points within the process, variations in the process that may affect the quality of the end product can be detected and corrected, thus reducing waste as well as the likelihood that problems will be passed on to the customer.

Quality assurance covers all activities from design, development, production, installation, servicing and documentation. It includes the regulation of the quality of raw materials, assemblies, products and components, services related to production and inspection processes.

Production logistics is the term used for describing logistic processes within an industry. Also, the purpose of production logistics is to ensure that each equipment and technologies is being fed with the right product in the right quantity and quality at the right point in time. What materials, products, or information come into the activity? What materials, products, or information flow out of the activity? Quality engineers use the D-M-A-I-C model (define, measure, analyze, improve, and control) to document processes before beginning process improvement. If processes are documented, another series of logical questions apply: Are the processes being followed? Are they within acceptable control and performance parameters? Are they outdated? Can they be improved? Those are the questions which determine the correlations between the logistics process and the quality assurance.

■ **QUALITY ASSURANCE IN THE ROLL INDUSTRY**

The manufacture of rolls (see Figure 1) is in continuously perfecting, the requirements for superior quality rolls are not yet completely satisfied, in many cases, the absence of quality rolls preventing the realization of quality laminates or the realization of productivities of which rolling mills are capable. Basic properties of rolls and properties of the material are two totally different sides of a problem and very often this difference is ignored. However, when we start to discuss about the rolls mechanical properties, we have to analyze the rolls material or the roll-properties.

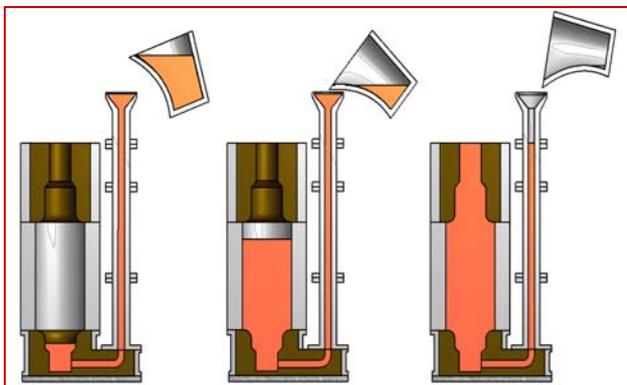


Figure 1. Casting technology of the iron rolls

The technological manufacturing process of the rolling mills rolls, as well as the quality of material used in manufacturing them, can have

a different influence upon the quality and the safety in the exploitation. Our approaches the issue of quality assurance of the rolling mills rolls, from the viewpoint of the quality of materials, which feature can cause duration and safety in exploitation. The quality assurance research fields can be defined through the general research area, through the different experiments effectuated in the laboratories, and, also, through the modern calculation programs, optimization technologies and the better capitalization of the manufacturing data (see Figure 2).



Figure 2. Quality assurance research fields



Figure 3. Quality assurance in rolling industry

In the rolling industry, the quality of the rolls is in directly accordance with the quality of technologies (defined by the casting equipments, materials, applied procedures, etc), and also, by the quality of the manufacturing process (charging, melting, inoculation, ladle treatment, casting, cleaning, etc), which are presented in Figure 3.

■ **QUALITY OF ROLLS ASSURED BY MODELLING OF MANUFACTURING**

Industrial engineering is also operations management, systems engineering, production engineering, manufacturing engineering or manufacturing systems engineering, where as most engineering disciplines apply skills to very

specific areas, industrial engineering is applied in every industry. Industrial engineers typically use computer simulation, especially discrete event simulation, for system analysis and evaluation. The computer is used to generate a numerical model of reality for the purposes of describing complex interaction among components of a system.

Starting from the principle of modeling process, used as necessary basic instrument, both in phase of conception, as well as in the industrial technologies analysis, is determined the optimum regimes of the cast rolls, from the view from chemical composition, as one as the most important parameters of disturbance of the manufacturing process. The enunciation of some mathematical modeling results, described through a number of multicomponent equations determined for the spaces with 3 the and 4 dimensions, as well as the generation of some regression surfaces, of some curves of levels, of the volumes of variation, of the lines of outlines of the volumes of variation of surfaces and the areas of variation of these, can be represented and interpreted by technologists and can be considerate diagrams of correlation between the analyzed variables. From this point of view the project is inscribes in context of scientific capitalization of the process and the industrial technologies optimizations, on the way of the analysis and the mathematical experiment. The quality assurance through the modeling phenomenon is presented in Figure 4.

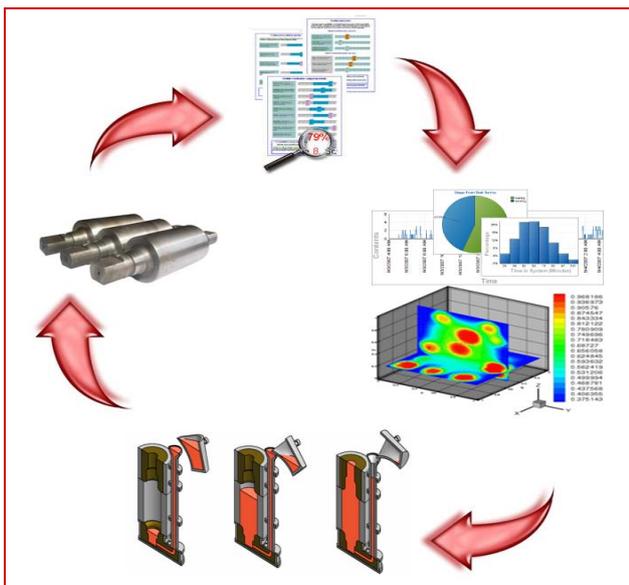


Figure 4. Quality assurance through the modeling phenomenon

The character of the metallurgical processes optimization is influenced by the complex peculiarities of these, which take place into a great number of variables (parameters) that operates independently or cumulate.

For this reason, to analyze the metallurgical processes is used, mainly, the statistical fundamental methods that permit to drawn conclusions, from the observed values, about the repartition of the frequencies of various parameters, about their interaction, about verification validity of certain premises, and about the research of the dependencies among different parameters. However, the statistical methods of the metallurgical process analyses do not solve a series of aspects regarding the mode of establish the decisions for the management of the process. Thereof, parallel with the statistical methods it was developed optimization methods.

The optimization of any technological process has, as a base, a mathematical model. The search for the best solution, for the truth, requests either to find, on the way of a study, definitive truths, or of relative valid truths, valid only in certain conditions, and which, in relation with the definitive truths, include implications and errors.

■ QUALITY OF ROLLS ASSURED BY THE LABORATORY EXPERIMENTS

The researches of durability in the exploitation of cast from cast-iron rolls, constitute a scientifically novelty, and experimentally define an important chapter from the thermal fatigue of the organs of machines in the movement of rotation, in variable temperature mediums. Hot rolling mills rolls work the in the variable compound solicitations, due to lamination process and which repeated to regular intervals of time.

All these phenomena, which are more or less emphases depending on the type and typical of rolling mills, are not taking into consideration in the classic calculus of rolls. If the study of the rolls resistance is extended upon their durability, we must consider the whole complex of tensions with mechanic-thermal influences.

The research on durability in exploitation of hot rolling mills rolls assures relevant conditions for the appropriation of the research methods of the thermal regimes that are submitted the rolls or

other organs of machines, that works in constant (symmetrical) or variables (asymmetrical) thermal sollicitation conditions.

The recommendations for the increase of the duration of exploitation and remove of the damages through the accidental rupture of rolls from the stands of lamination, the attenuation of rolls thermal fatigue, the avoiding of thermal shock and their rational exploitation are actuality issues that must be continuously researched.

In this trend is situated the research of the thermal fatigue phenomena, materialized in technical reports, whose beneficiary is the unit in which the rolls are exploited, as well as through scientific papers, that can develop the framework of scientific research. These researches results lead to direct conclusions about the cast-iron rolls, and permit their comparison with date about steel rolls, area studied thoroughly researched of specialists. The quality assurance through the laboratory and industrial experiments is presented in Figure 5.

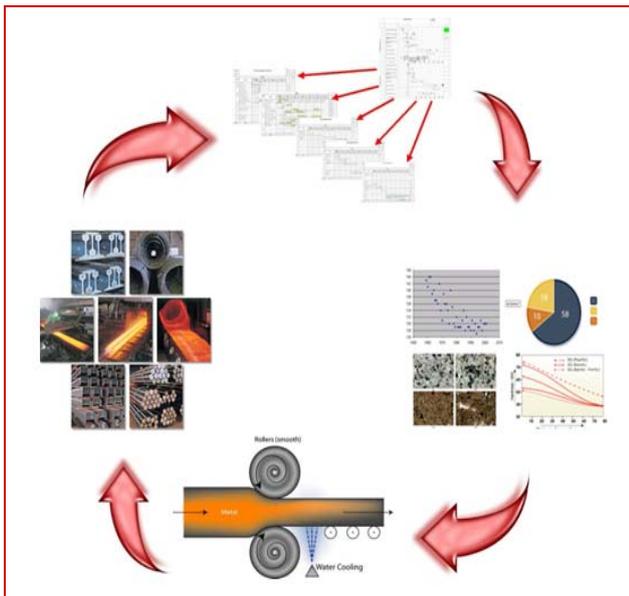


Figure 5. Quality assurance through the laboratory and industrial experiments

The work is of practical immediate utility, inscribing itself in the context of technical capitalization of the manufacturing technologies and of exploitation of cast-iron rolling mill rolls, for which exists an attentive preoccupation both from foundry sectors, as well as from lamination sectors, having as determinate aim the quality assurance and increase the durability in exploitation.

CONCLUSION

The aim of the propose research is to answer to as many questions possible regarding the quality of rolls. In this sense, durability in exploitation is extremely current, both for immediate practice, and for the scientific research attributed to the cast-iron. Also, the realization of optimum chemical compositions of the cast-iron can constitute a technical efficient way to assure the exploitation properties, the material from which the rolling mills rolls are manufactured having an important role in this sense.

In these sense, our researches propose, on aside, to analyze the durability in industrial exploitation of rolling mills rolls – analysis materialized from prism of the laboratory experiment (see Figure 4), and on another side, the optimization of manufacturing technology of the cast rolls, especially those from cast-iron – using electronic calculus technique as the modeling phenomenon (see Figure 5) and mathematical interpretation of the technological processes.

The research on durability in exploitation of hot rolling mills rolls assures relevant conditions for the appropriation of the research methods of the thermal regimes that are submitted the rolls or other organs of machines, that works in constant (symmetrical) or variables (asymmetrical) thermal sollicitation conditions. Also, it can be emphasized the thermal shock, phenomenon that constitutes a permanent danger, which leads to rupture, specific to rolling mills rolls.

On another hand, the realization of an optimal chemical composition can constitute a technical efficient mode to assure the exploitation properties, the material from which the rolling mills rolls are manufactured having an important role in this sense. From this point of view is applied the mathematical modeling, witch is achieved starting from the differentiation on rolls component parts, taking into consideration the industrial data obtained from the hardness on rolls, as well as the national standards reglementations, which recommends the hardness, for different chemical compositions.

Through its nature, the quality assurance in the rolls manufacturing is a research with interdisciplinary character. It approaches, on aside, the technical area of manufacturing and

exploitation of rolls, both in theory and practice, and on the other hand, the areas of the statistical mathematic analysis, of the algorithms and the numerical calculus methods, as well as the mathematical molding and optimization area, applied to a product so simple from point of view of the geometry, but so complex, as structure, property and characteristics ensued, as the rolling mills rolls are.

These results are immediate practical utility both the cast-iron rolling mills cylinders manufacturing industry, and the rolling sectors. In this sense, these researches results can be used in the collective framework of the foundries and the rolling mills sectors, for assurances quality of rolls as far back as phase of production, as well as in exploitation these, what lead to, inevitably, to the assurance quality of produced laminates.

Through the original aimed elements mentioned above, the suggested researches allow the enunciation of new approaches in the area afferent to the theme. The best way for roll makers to achieve better rolls is to ensure that better materials and improved manufacturing processes are used and that roll users take account of rolling conditions and improved rolling processes. When we start to discuss about the rolls mechanical properties, we have to analyze the rolls material or the roll-properties. In conclusion, the rolls quality problems can be solved by good co-operation between the rolls manufacturers and roll users.

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THE ECONOMIC CRISIS AND THE SUSTAINABLE DEVELOPMENT

■ **Abstract:**

One of the constituents of the sustainable development is economic sustainability, along with the social, environmental and institutional dimensions.

In business, there are only companies which manage their economic sustainability as no amount of excellent social and environmental performance will prolong the life of a company that is economically unsustainable.

It is only obvious that economies and communities are to a high degree affected by business failure and economic instability having a disastrous effect on people. However, businesses that only measure success against financial indicators, such as turnover and profit, increasingly risk failure. A broader perspective on sustainability is now emerging, based around reputation, full cost accounting, ability to add value and the management of knowledge.

Summarizing specific challenges, it is critically important that the European Union has resident (citizen) capacity to carry out strategic planning on a continuing basis. While this capacity will in the short-term necessarily have to depend on externally supplied expertise, more institutional strengthening will be required to ensure the development and institutionalization of planning and policymaking capacity at both national and state levels.

■ **Keywords:**

Sustainable development, economic crisis, strategic planning

■ **GENERAL CONCEPTS REGARDING THE
SUSTAINABLE DEVELOPMENT**

The term of „sustainable development” appeared in earlier decades due to a high number of environmental movements. It was first defined by World Commission on Environment and Development (WCED) as the development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.” [1] This definition is clear enough, not requiring any further explanations. But there are two more

questions worth thinking about: Why should we think about the future generations and how can we implement a sustainable development?

Referring to the first problem, taking into consideration the sustainable development not only helps our children, grand-children, grand-grand-children and so on, but also helps us. It helps us live a better life in a better world reducing pollution, uncontrolled waste dumping, controlling the resources which, in the end, reflects in the increase of our life expectancy. Moreover, from the economical point of view, we will be able to better fulfill our

needs, as individuals, as long as we take into consideration a good management of our personal resources and we keep our consumption levels under control.

However, how do we get to the sustainable development? Starting with 1992, at the Earth Summit, held in Rio de Janeiro, the EU identified the need for sustainable development in Europe. There has been developed a strategy (which was renewed in June, 2006) that focuses on climate change and biodiversity. The challenges identified which European Union has to face are:

- Climate change and clean energy
- Sustainable transport
- Sustainable consumption and production
- Conservation and management of natural resources
- Public health
- Social inclusion, demography and migration
- Global poverty

Unfortunately, although the first summit concerning sustainable development took place 17 years ago, the progress in this direction is still not very significant and visible. This is also due to the different ways of understanding and implementing the concept of sustainable development in EU's state members mostly characterized by the reticence towards this concept met in poorer countries. Many state members tend to believe that the implementation of a good sustainable development strategy is expensive, thus unaffordable or they even consider it "a brake to development". In this situation, it is no wonder that the strategy did not achieve its goals. Still, new goals have been set, among which the limitation of the climate change and the reduction of the greenhouse gases by 20 percent by 2020. How and if this targets will be met, remains to be seen.

■ EU SUSTAINABLE DEVELOPMENT POLICY

The main focus of the European Union Sustainable Development Strategy (EU SDS) is to progressively achieve the change in the current unsustainable consumption and production patterns and the non-integrated approach to policy making. Of course this can be obtained only by succeeding in raising awareness among communities in order to improve the quality of life for both the nowadays generations and the

future ones. Being able to efficiently manage and use resources to trigger the ecological and social innovation potential of the economy, building up a prosperous and protected environment, as well as social cohesion. The cross cutting policies are:

1. Education and training.
2. Research and development.
3. Financial and economic instruments.
4. Communication, mobilizing actors and multiplying success.

Obviously three main actions are most significant in achieving the goal and these are – implementation, monitoring and follow up. Starting September 2007 a new rule has been set – the Commission has to submit every two years a progress report on the success of the implementation of the above mentioned directions in the European Union and the Member States, as well as on future actions and targets.

The two issues that keep coming up in the debate are the quantification of the progress made by EU and the Member States in implementing EU SDS and the setting of future targets.

In this respect, a very high importance is given to the climate change and clean energy. All the Member States, as well as EU, agree that this is a very important theme, therefore the number of initiatives that have been taken. One example would be the focus on renewable energy and biofuels which has caught the public's eye. Unfortunately, not so much attention is being paid to post-2012 emission reduction and adaptation to climate change, which is becoming a more and more urgent matter. In what concerns the climate change and clean energy there is a lack of coherence between objectives and actions. Thus the adaptation to climate change has no corresponding actions attached to it and therefore we need strategies to reach the already mentioned objectives. There are policies such as agriculture, trade policy, research and technology development which although are not directly connected to the climate change issues can influence the sustainable development and mainstreaming energy.

In the field of sustainable tourism the energy use and the greenhouse gas emissions are in focus. The problems concerning the sustainable tourism refer to separating the economic growth

and energy consumption from the increase in demand for transport. This can be helped by providing a real market price for the different means of transport. Improving the technology in the field is another way to help the sustainable tourism in what concerns the obvious energy consumption and emissions. The transport by air demand is highly increasing in Europe, being estimated to double by 2020.

With regard to the progress, there are limited reasons for showing optimism in the area of sustainable transport. The growth of freight transport volumes has outpaced economic growth since 1995 and growth of passenger freight transport has exceeded economic growth between 1990 and 2002. Growth in transport related energy use has exceeded growth in energy use in all sectors: transport's share of total energy consumption is rising and oil provides 98% of the energy used by the transport sector. Greenhouse gas emissions from transport are increasing and it is questionable whether targets in this area can be met. Although harmful, polluting emissions are decreasing, air quality problems in European cities still persist. A shift to environmentally friendly means of transport is unfortunately not a reality at the moment: road freight transport is still dominant and continues to grow; passenger air transport has increased significantly; passenger car transport shares have remained constant. The pollution through noise is as well on debate, although there is not, at the date, a valid data in support of the negative effect it has on the quality of life.

Obviously, the challenge faced by all the Member States to apply the measures for a sustainable development is great. It requires good inter-ministerial cooperation and horizontal methods of working, along with the ability to synthesize all outputs varies considerably between the Member States.

■ **ECONOMIC RECESSION – AN OPPORTUNITY FOR TRANSFORMATION**

The issue of origin and nature of economic cycle is one of the most important and the oldest unsettled problem of economy theory, still a very actual problem. A lot of the most famous scientists-economists studied phenomena of economic cycles, economic dynamics and development. Among them one

can name: Karl Marx, Wickcell, Mitchell, Tugan-Baranovsky, Gassel, Schumpeter, Kondratyev, Harrod, Hansen, Aftalion, Clark, Spiethof, Kuznets, Pigou et al. and, according to Hansen, this problem had not been solved till the time of his work (40s of the 20th century) (Hansen, 1997). By analyzing, comparing and contrasting the works of economists of the second half of the 20th century, it is possible to say that his statement remains true until now. Methodology that exists today in economics and its sections – theory of economic dynamics and theory of economic development – has come from classical mechanics [Kondratyev, 1998; Schumpeter, 1982]. Today is a time of complexities. It looks that the organization of universal system is complex, intricate and functions according to non-linear laws. The idea of complexity itself became the focus of scientific thought. Non-linear physics and physics of open systems have occupied their place in educational and research processes of physics (Zaslavsky and Sagdeev, 1988; Klymantovich, 1999; Bar Yam, 1997). The concept of self-organization of physical objects is confirmed as open dissipation systems. Fundamental categories of physics are newly interpreted from the position of new knowledge of complexity. The same phenomenon can be observed in economics as well. Wide diffusion of knowledge, including methods, occurs among different branches of science. Interdisciplinarity of research is one of the fastest spreading scientific methods. Our work is interdisciplinary. It is an attempt to consider economic problem from position of non-linear physics, or, more exactly, - from position of physics of non-linear wave processes. So we are aware that "pure" physicists interested in economics can reveal triviality and even dilettantism in stated context and they will be right.

Economists, acquainted with physics, can reject the very method of approach and they will be right as well. It is due to the fact that economics studies human objects, the ones possessing reason and right to choose and making decisions, i.e. biological objects, while physics studies physical objects.

In such times, when companies struggle to remain on the market, a good question arises: can we still afford to focus on sustainable development?

Some claim that now is the best time to do that and that right now it should be clear to everyone that we can not go on as we have been.

Always in the face of challenge, a lot of new opportunities appear. We just need to seize the moment and make the most of them. Our future (as individuals and as a society, as a whole) depends on it.

The “big questions” here are: how do we build a more sustainable society with lower energy and resource use? How do we create the “green jobs” that will be needed to deliver these solutions? And how do we create a societal infrastructure that will be more resilient to the challenges of climate change and its impacts on our food and water supplies?

The amount of investment needed for energy, urban infrastructure, water, transport and food supply, to mention a few, will be tremendous, but we can not allow these investments to lock us into an unsustainable future. The infrastructure we invest in today will be with us a long time (50 years or even more). It is vital that governments remember this when designing the future infrastructure. They need to look forward to the low-carbon economy of the future and focus on investments in new energy systems, transport solutions, energy-efficient buildings and water and urban infrastructure. Making the right decisions now will spur new industries, create “green jobs”, change our lives and secure our future.

We need to be thinking across the board, and outside of the usual constraints. With vision, foresight and planning, the world can be re-shaped. Imagine, for instance, a life in the future, where our homes and industries are powered by low-carbon energy, where transport runs on clean fuels, where even the poorest people have easy access to clean water, where our buildings and household appliances consume less energy, and where workers equipped with new, “green” skills are employed in the abundant jobs these new industries create. All these represent opportunities for new businesses and growth. But the achievement is not possible by thinking in silos and within narrow national borders. A global view is required. We must take advantage of these opportunities. Future generations will not thank us if we fail.

■ ECONOMIC SUSTAINABILITY

One of the constituents of the sustainable development is economic sustainability, along with the social, environmental and institutional dimensions.

The term of economic sustainability does not only refer to achieving economic growth every year, but also at understanding that economic growth is only sustainable if it simultaneously improves our quality of life and the environment.

Along with ways of a business to operate and its financial stability, economic sustainability involves the generation of community capital, such as local sourcing, employment, partnerships and investment.

In business, there are only companies which manage their economic sustainability as no amount of excellent social and environmental performance will prolong the life of a company that is economically unsustainable.

In time, there have been set certain models of the sustainable development, therefore it is well-known that in order to obtain the sustainability each of the four subsystems (economic, social, environmental and institutional) has to maintain its capability to survive and evolve, while the connections of the subsystems must enable a permanent co-evolution. It has always been a challenge to identify the perfect level of complexity for descriptions and models in order to develop adequate analysis and to avoid wrong prognoses and this is sometimes beyond the analytical capacities of current economic theories. In this way, a system analysis perspective is presented as a framework for debating the co-evolution of economy, society, and nature. In this context, the economic, social, environmental and institutional sustainability of the economy can be defined and economic theories can be assessed regarding their usefulness for the description of a complex evolving system, like the economy.

In business, there are only companies which manage their economic sustainability as no amount of excellent social and environmental performance will prolong the life of a company that is economically unsustainable.

It is only obvious that economies and communities are to a high degree affected by business failure and economic instability having

a disastrous effect on people. However, businesses that only measure success against financial indicators, such as turnover and profit, increasingly risk failure. A broader perspective on sustainability is now emerging, based around reputation, full cost accounting, ability to add value and the management of knowledge. However, the present tax system acts in the direction of discouraging small business as it encourages waste, discourages conservation, and rewards consumption. The tax system needs a major overhaul to favor the legitimate and critical needs of the small business community. Retention of capital through retained earnings, efficiencies, and savings is central to small business competitiveness. Current tax policies often act to unfairly penalize small business. To sum up, sustainable development is and always will have to be taken into account as it decides not only the economical welfare and growth, but also the quality of life. Summarizing specific challenges, it is critically important that the European Union has resident (citizen) capacity to carry out strategic planning on a continuing basis. While this capacity will in the short-term necessarily have to depend on externally supplied expertise, more institutional strengthening will be required to ensure the development and institutionalization of planning and policymaking capacity at both national and state levels.

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DETERMINATION OF THE CURRENT HARMONICS INTRODUCED IN THE GRID BY THE D.C. - SUPPLIED CONSUMERS

■ **Abstract:**

This work is presenting a determination mode of the current harmonics for a supply circuit of a d.c. motor, to which the loading is adjusted by another identical motor, connected as generator. Their determination is achieved by direct measurement with an energy analyzer CA8334.

■ **Keywords:**

current harmonics, single-phased power rectifier, distortion factor

■ **WORK'S PRESENTATION**

For the current harmonics' study it was achieved a circuit of relatively reduced power using a d.c. motor of 750 W coupled directly with another motor, identically with the first one, which is connected as generator, to which the loading can be adjusted by means of a slide rheostat. The electric circuit's diagram (fig. 1) allows the adjustment of the motor's supply voltage using a single-phased autotransformer. Will be analyzed the current harmonics for three different loading situations of the generator, respectively three values for the slide potentiometer, at three different supply voltages. Determinations of the current harmonics, as well as the THD factor, are made with a three-phased energy analyzer CA8334 which allows the calculation of these parameters as follows:
1 sec RMS values for voltage and current

$$V_{rms}[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} V[i,n]^2} \quad (1)$$

where: V_{rms} single rms voltage $i+1$ phase;

$$V_{avg}[i] = V_{rms}[i]$$

$$U_{rms}[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} U[i,n]^2} \quad (2)$$

where: U_{rms} compound rms voltage $i+1$ phase

$$U_{avg}[i] = U_{rms}[i]$$

$$A_{rms}[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec} A[i,n]^2} \quad (3)$$

where: $A_{rms}[i]$ - Effective current phase

$$i+1; A_{avg}[i] = A_{rms}[i]$$

Calculation of harmonic bins:

By FFT (16 bits) 1024 samples on 4 cycles without windowing (CEI 1000 -4-7). From real and imaginary parts, each bin calculated on each phase V_{harm} , U_{harm} and A_{harm} in proportion to the fundamental value and the angles V_{ph} , U_{ph} , and A_{ph} between each bin and the fundamental.

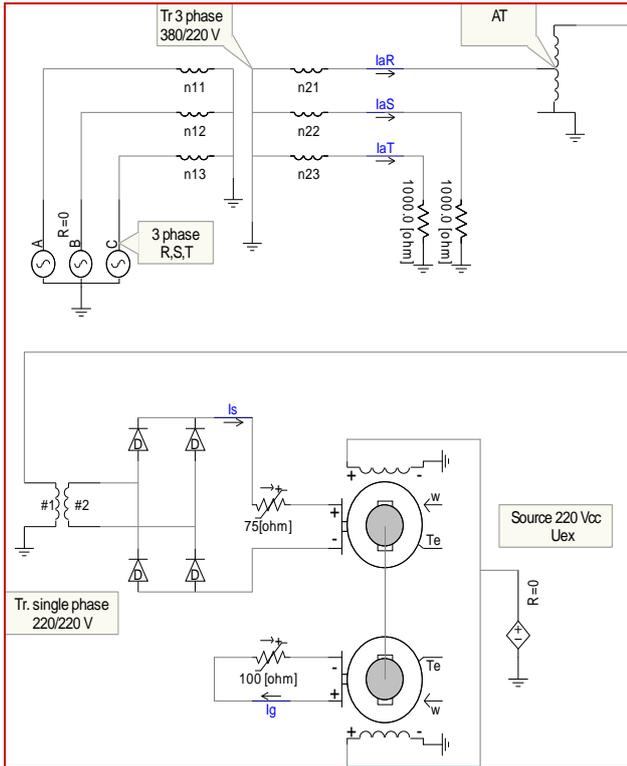


Figure 1 The d.c. motor's control circuit

This calculation is done with the following principle: Module in % : $\text{mod}_k = \frac{c_k}{c_1} \times 100$ angle

in degree: $\varphi_k = \arctan\left(\frac{a_k}{b_1}\right)$

$$\text{with } \begin{cases} c_k = |b_k + ja_k| = \sqrt{a_k^2 + b_k^2} \\ b_k = \frac{1}{512} \sum_{s=0}^{1024} F_s \times \sin\left(\frac{k\pi}{512} s + \varphi_k\right) \\ a_k = \frac{1}{512} \sum_{s=0}^{1024} F_s \times \cos\left(\frac{k\pi}{512} s + \varphi_k\right) \\ c_0 = \frac{1}{1024} \sum_{s=0}^{1024} F_s \end{cases} \quad (4)$$

c_k is the amplitude of frequency $f_k = \frac{k}{4} f_1$, F_s is sampled signal, c_0 is the DC component, k is the ordinal number (spectral bin).

Calculation of the distortion factor (DF): There are calculated two global values which give the relative quantity of harmonics: total harmonic distortion (THD) against the fundamental and the distortion factor (DF) and DF against the effective value (RMS).

$$V_{thd} [i] = \frac{\sqrt{\sum_{n=2}^{50} V_{harm} [i, n]^2}}{V_{harm} [i, 1]}$$

$$U_{thd} [i] = \frac{\sqrt{\sum_{n=2}^{50} U_{harm} [i, n]^2}}{U_{harm} [i, 1]}$$

$$A_{thd} [i] = \frac{\sqrt{\sum_{n=2}^{50} A_{harm} [i, n]^2}}{A_{harm} [i, 1]} \quad (5)$$

$$V_{df} [i] = \frac{\sqrt{\frac{1}{2} \sum_{n=2}^{50} V_{harm} [i, n]^2}}{V_{rms} [i]}$$

$$U_{df} [i] = \frac{\sqrt{\frac{1}{2} \sum_{n=2}^{50} U_{harm} [i, n]^2}}{U_{rms} [i]}$$

$$A_{df} [i] = \frac{\sqrt{\frac{1}{2} \sum_{n=2}^{50} A_{harm} [i, n]^2}}{A_{rms} [i]} \quad (6)$$

Multiplying the voltage's harmonics factor with the current's harmonics factor, results the power's harmonics factor. Differentiating the voltage's harmonic phase angle with the current's harmonic phase angle, results the power's phase angle.

- different ratios

$$PF[i] = \frac{W[i]}{VA[i]} \text{ power factor, phase } i + 1$$

$$\cos(\varphi[i]) = \frac{\sum_{n=0}^{N_{chSec}-1} V_{F}[i, n] \cdot A_{F}[i, n]}{\sqrt{\sum_{n=0}^{N_{sec}-1} V_{F}[i, n]^2} \cdot \sqrt{\sum_{n=0}^{N_{sec}-1} A_{F}[i, n]^2}} \quad (7)$$

Cosinus angle between the voltage's fundamental and the phase current $i + 1$

$$PF_3 = \frac{PF[0] + PF[1] + PF[2]}{3} \quad (8)$$

Total power factor various types of energy

$Wh[0, i] = \sum_{T_{int}} \frac{W[i]}{3600}$ active energy consumed $i + 1$ phase;

$VAR_{hL}[0, i] = \sum_{T_{int}} \frac{VAR[i]}{3600}$ for $VAR[i] \geq 0$ Reactive inductive energy consumed $i + 1$ phase;

$VAR_{hC}[0, i] = \sum_{T_{int}} \frac{VAR[i]}{3600}$ for $VAR[i] \leq 0$ Reactive capacitive energy consumed $i + 1$ phase.

Table 1

Motor loading	Is [A]	Ig [A]	IaR[A]	THD[%]
min	2.4	1.2	2.1	14.6
med	3.1	1.8	3	15.1
max	4.1	2.5	3.8	15.5

There are obtained the amplitude values of the harmonics of rank 3,5,7,9, 11..... and the THD factor calculated for there values of the harmonics. In the first stage, are determined the current harmonics and the THD for the situation when the insulation transformer is missing (Tr single-phase). The results will be written in a table (table 1) and, for exemplification, there are presented two graphics with the harmonics' values and the THD's value for a medium loading (fig. 2), respectively for a maximum loading (fig. 3).

d.c. motor of 50 V, 100 V, 150 V at loading of the generator with minimum, medium and maximum load. The values are written in the table (table 2) and for the supply voltage of 100 V will be presented two distinct situations, at a medium loading of 50 % from the value of the generator's loading potentiometer (fig.4) respectively maximum, 10% from 75 Ω (fig.5).

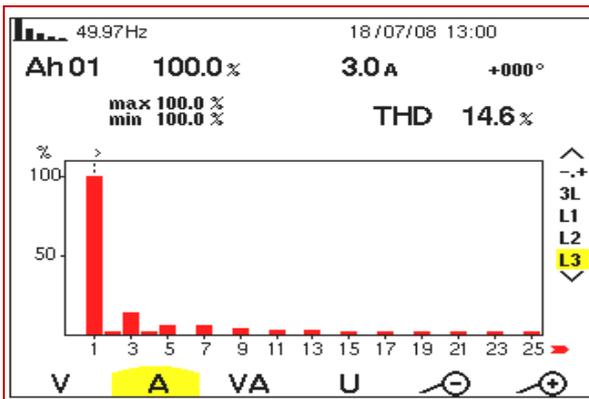


Fig. 2 Harmonics spectrum for a loading of 50%

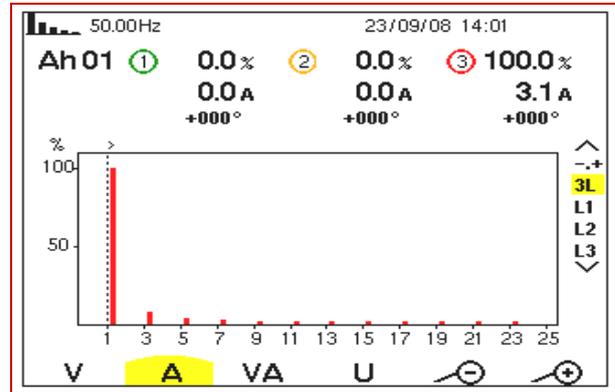


Fig. 4 Harmonics spectrum for a loading of 50% with insulation transformer

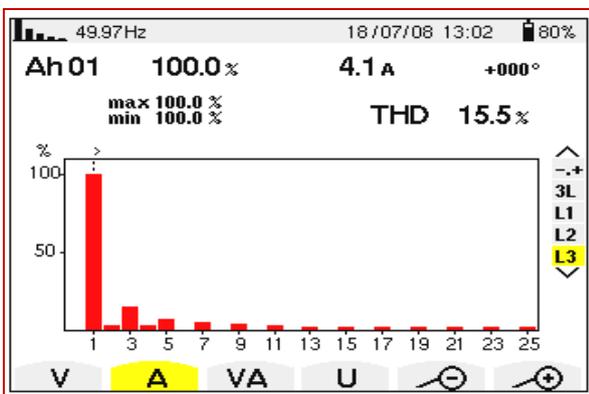


Fig. 5 Harmonics spectrum for a loading of 100%

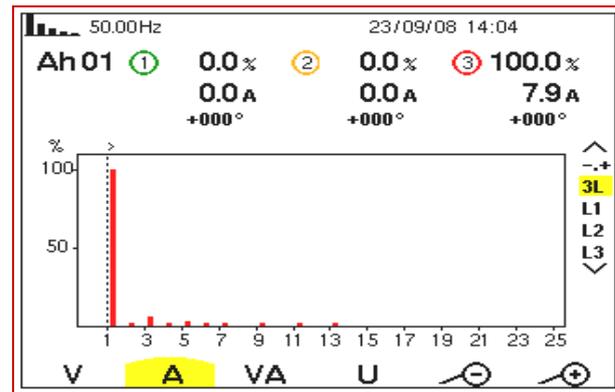


Fig. 5 Harmonics spectrum for a loading of 100% with insulation transformer

Table 2

Voltage [V]	Motor loading	Is [A]	Ig [A]	THD [%]
50	min	0.8	0.5	13.2
	med	0.9	0.65	14.8
	max	1.1	1	16.3
100	min	5.9	1.5	6
	med	6.7	1.8	5.9
	max	7.9	2.75	3.5
150	min	8.4	1.55	4.8
	med	9	2	4.7
	max	10.4	2.7	4.6

In the circuit is introduced the insulation transformer (Tr single-phase), and are rerunned the measurements for the supply voltages of the

CONCLUSIONS

In case of the circuit without insulation transformer from fig. 2 and fig. 3 can ne noticed a relatively small reduction of the distortion factor regarding the load currents at medium and maximum loading.

In case of the circuit with insulation transformer from fig. 4 and fig. 5, beside the pronounced THD's reduction, is noticed also a more pronounced reduction between the situation of medium loading and maximum loading of the d.c motor.

It can be easily noticed the reduction of the distortion factor in case of introducing the insulation transformer. Although the harmonics' values are relatively reduced related to the

fundamental, is obtained a relatively high THD factor, especially at small load currents. By increasing the load current, the harmonics' effective value is not really reducing. The finding of the THD's reduction is due to the relative reduction of the ration between the harmonics' values and fundamental. Reduction of THD is achieved by using of passive filters at small rank harmonics, completed by a power active filter.

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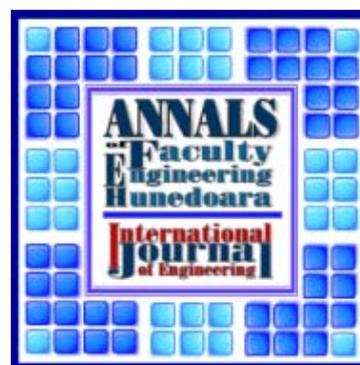
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INTERACTIVE AND COLLABORATIVE LEARNING IN MECHANICAL ENGINEERING USING INTERNET

■ Abstract:

In the process of preparing tomorrow's engineers and scientists, the universities are facing the challenge of gradually teaching students a reality of modern mechanical engineering, namely the mechanisms that occur from the interaction between different parts of complex technical systems. The use of Internet in the classroom offers the opportunity of efficiently adopting methodologies and advanced learning systems that can help the students to expand their views and explore new frontiers. This paper describes our experience concerning the possibility of using dedicated software (via Internet), for an interactive and collaborative learning in mechanical engineering.

■ Keywords:

mechanical engineering, educational dedicated software resources

■ INTRODUCTION

Globalization and advances in information technology have prompted a change in the credentials of the engineers today. Industry needs engineers who can work in a distributed, multifunctional, cross-cultural and multidisciplinary avenue. For responded to this change, in the process of preparing tomorrow's engineers and scientists, the universities are facing the challenge of gradually teaching students a reality of modern engineering, namely the mechanisms that occur from the interaction between different parts of complex technical systems.

The formal lecture, the oldest teaching methods, has been widely use in higher education for centuries. But lecturing alone cannot ensure that students become active learners. Generally, using lectures in combination with other kinds of instruction, such as discussion and

cooperative learning, can increase their effectiveness.

The activities used to reach students with different learning styles are very important, while people have different preferences for processing new information. One recent "hot topic" in higher education has been the different ways in which students learn: some students prefer to learn by listening, others like visual representations, and still others learn by doing. Incorporating of various resources into lectures and seminar applications improves the chance of understanding of concepts by students with different learning styles. Possibilities include demonstrations, role plays, discussions, simulations, problem-solving, real-world applications, or multi-media.

USING OF THE DEDICATED EDUCATIONAL SOFTWARE IN MECHANICAL ENGINEERING EDUCATION

In mechanical engineering education, the concepts developed in the mechanics of materials course, essential in preparation for design courses in the engineering technology disciplines, provide the designer with the tools needed to choose an appropriate material and to establish the necessary sizes for the machine or structure. For the student, the key to success in the course is to develop technical problem-solving skills by working a number of problems taken from a wide variety of mechanical and structural situations.

This paper exposed our experience on the use of the educational software, exemplified with the software called MDSolids, [2], a computer program dedicated to aid students in the study of Mechanics of Deformable Solid. MDSolids was conceived as a tool to help students solve and understand homework problems typically used in the mechanics of materials course and consists of a number of modules, Figure 1a, each focusing on a type of problem typically studied. The software features educational routines for beams, flexure, torsion members, columns, axial structures, statically indeterminate structures, trusses, section properties, Mohr's circle analysis and stress and strain transformations.

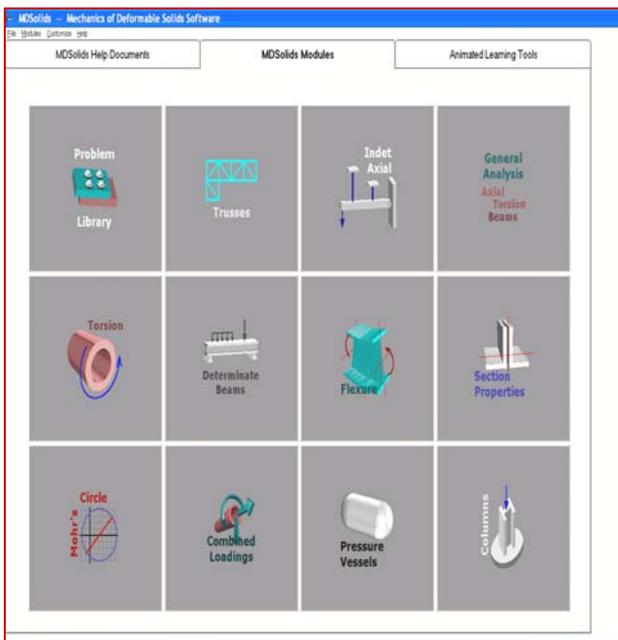


Figure 1. MDSolids Modules - Games and Learning

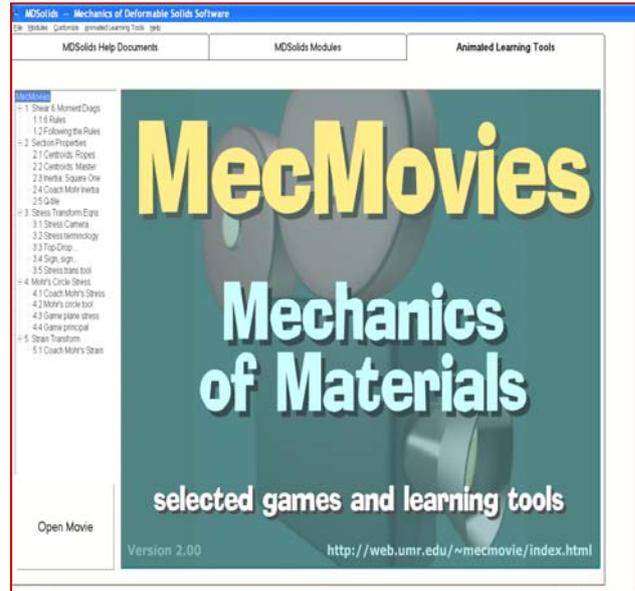


Figure 2. MDSolids Modules - Tools Modules

Also, MDSolids contains modules of Animated Games and Learning Tools, Figure 1b, for topics such as: Shear force and bending moment diagrams, Section properties (centroids, moment of inertia, Q), Stress transformation equations and Mohr's circle stress and strain transformations.

Concerning the MDSolids style, this educational software varies from a slideshow presentation of lecture notes to a MathCAD- or TKSolver-type of equation worksheet to a full structural analysis software package. The analysis routines are grouped in modules devoted to particular mechanics of materials concepts and problem-solving methods. MDSolids is powerful enough so that many different combinations of structure configuration and loading can be solved within each module and it is coordinated so that results from one module can be used in related modules. The modules are constructed so that data for a particular problem can be entered directly and intuitively from a textbook (see Figure 3). MDSolids does not require the user to know a particular sign convention or to enter the data in a particular set of units. Where necessary, the software presents these options in either a pictorial or descriptive fashion. MDSolids' solutions give the final number and, also, show a picture of how the structure deforms and how the stresses are distributed.

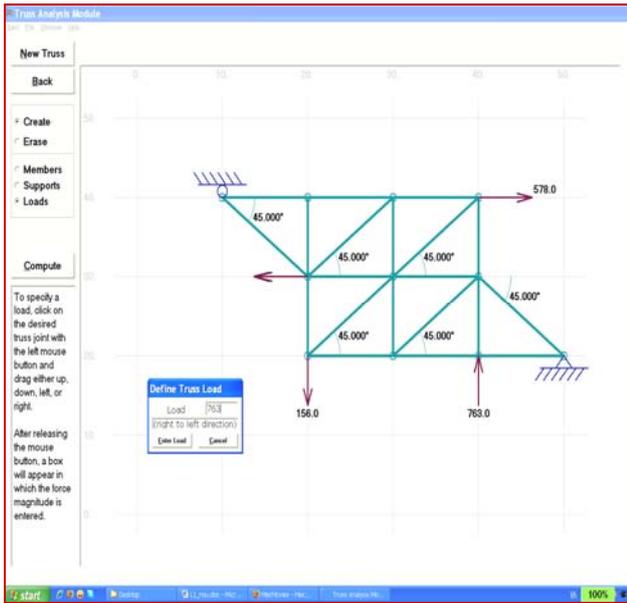


Figure 3. Sample of particular values entering

So, for the student, MDSolids can be helpful in several ways:

- ✚ The MDSolids solution can confirm the results obtained by hand calculations. If the hand calculations are incorrect, the complete solution provided by MDSolids can be used to track down errors in the hand calculations.
- ✚ The solution of typical mechanics of materials problems can be somewhat lengthy. With the MDSolids solution as a reference to keep the hand calculations on track, more problems can be attempted and solved. This problem-solving practice is essential to firmly understand the concepts.
- ✚ MDSolids can build confidence in the problem-solving method needed for the various types of problems included in the modules. The software can also help the student to develop a "feel" or intuition for what the correct answer should be. Confidence in the method plus engineering intuition about the outcome will conquer most of the difficulties commonly encountered in the mechanics of materials course. (Figure 4 and Figure 5).
- ✚ MDSolids provides brief text commentary describing the solution, Figure 6. These explanations can help students develop the problem solving skills needed to succeed in the mechanics of materials course. The mechanics of materials course can be a much more satisfying educational experience if students get some extra help

from a program such as MDSolids so that they can get themselves on the right track from the start.

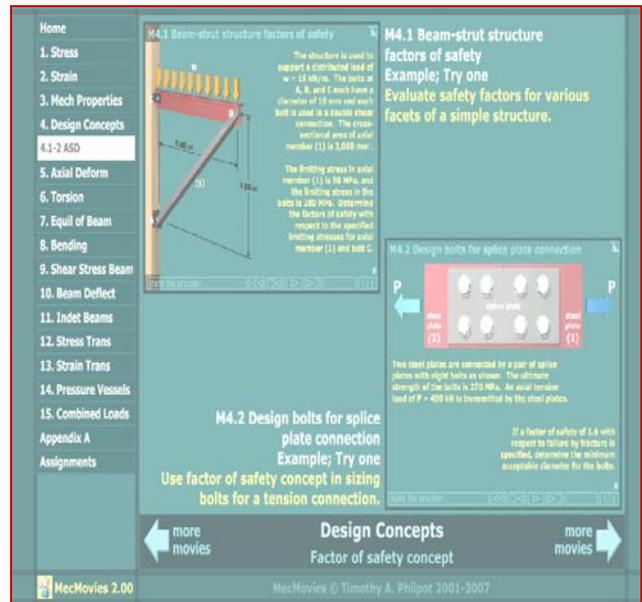


Figure 4. The Safety factor Concept in MecMovies Module

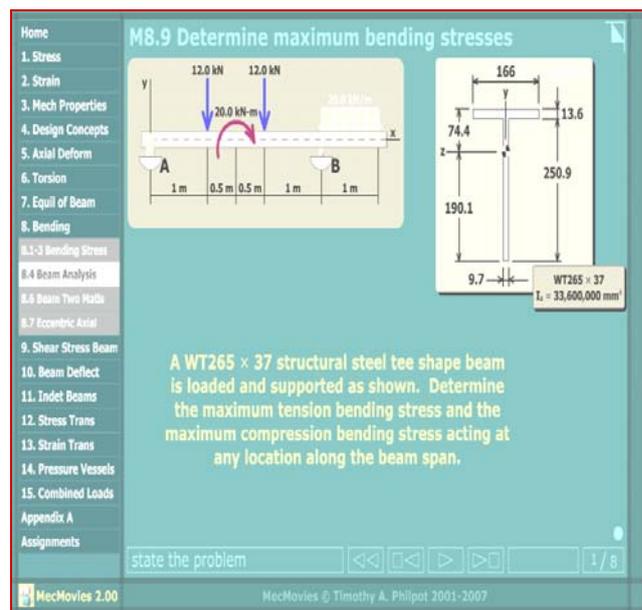


Figure 5. Beam analysis in the Design Concepts Module of MecMovies

- ✚ MDSolids has a Help folder to provide additional information about using the software and the software "navigator". The Help folder also contain a number of files with worked examples that describe the procedures used to solve the problems. The MDSolids Navigator is intended to help the software in the context of Mechanics of Materials studies. At opening of a book that corresponds to class textbook, will find a list

of problems that can be solved and explained by MDSolids. By click on a problem number, the MDSolids Navigator will briefly describe the steps that are required to make MDSolids solve the problem.

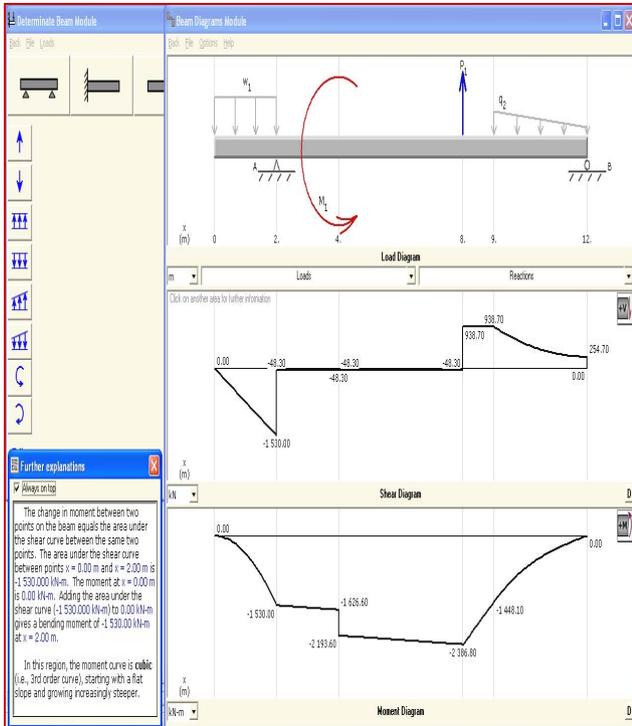


Figure 6. Comments on the solution in the describing box

DISCUSSIONS, APPROACHES AND INTERPRETATIONS

To develop the student understands of the mechanics of materials topics, homework assignments are the primary device used. The typical assignment can be somewhat lengthy; therefore, only selected problems can be assigned. Professors may expect that their students will work enough extra problems so that the fundamentals are firmly grasped, but students sometimes struggle just to keep up with the homework and exam schedule. To supplement the student's educational development, the self-study potential offered by software would seem to be the ideal means of filling the gap between the material presented in lectures and the understanding and skills expected in homework and exams.

Educational Benefits to use dedicated software, with on-line accessibility:

- ✚ This can help students study mechanics of materials and develop the necessary

problem solving, skills in several ways that are not inherent in lectures or customary assignments.

- ✚ Obtain correct Solutions and Intermediate Results: when learning a new concept, it's very helpful to use the correct solution as a benchmark. Knowing that the problem has been solved correctly gives the student confidence in their problem-solving skills and thereby provides a foundation for more challenging problems. Every textbook provides answers to selected problems for this reason. Software can provide the student with the correct solution for a particular problem, but in addition to the final answer, software can provide intermediate solutions that can be used to confirm the calculations along the way. These intermediate results can be helpful in tracking down faults in the problem-solving approach.

- ✚ What-If Analyses: Observing a cause-and-effect relationship can be quite helpful to students. For example, a student can develop a sense of the column buckling phenomenon without calculating a single number by assuming various end support conditions and then observing the effects on the buckled shape. This can help students to develop engineering intuition that will help them know what the correct solution should be before they calculate a single number.

- ✚ Availability: In the evening hours, during weekends or when working at home (which may be distant from the classroom), students don't have access to professors, graduate assistants, or others who can help them understand the course material. Having a versatile software tool at hand to supplement the textbook and lecture notes can be a big asset.

- ✚ Repetition: Some people must see or perform more repetitions involving a concept before they begin to fully understand it. Time limits the number of examples that can be presented in lectures and textbooks can present only a few examples. With software, students can drill themselves, trying various numeric combinations for a particular problem type until they feel confident in their understanding of the concepts.

- ✚ Visualization: Software can depict deformations or show stress distributions

produced in the problem being considered. Visualization of the material's behavior in response to the loads acting on it can help the student to understand the relevant theory and to develop engineering intuition.

Mechanics, American Society for Engineering Education, Annual Conference & Exposition 2002

■ **CONCLUSIONS**

According to the exposed ideas, for a modern education in mechanical engineering field, there is a need to change the traditional lecture based of a passive learning methodology to an active technology using interactive and collaborative learning and the facilities offered by the information technology.

A very good and already experienced example can be the using of MDSolids software (by Timothy A. Philpot at Murray State University, [2]). That offers students numerical, descriptive, and visual results and details that illustrate and explain many types of problems in introductory mechanics of solids courses.

Compared with traditional instruction techniques, the using of educational software supports a learner's development of basic concepts and problem-solving skills through self-study.

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STUDIES AND TESTS CONCERNING SMELTING CASTING ALLOY OF UNIVERSAL ALUMINIUM

■ Abstract:

The direct consequence use on a major scale a silumin alloy type at casting pieces which working at high temperatures, e.g. thermal engine pistons, is: finding, smelting an alloy that possess good mechanical and technological properties, with preservation of those properties for a long time. The most recommended are Al-Si alloys type, allied with addition agent (Ea) such as Cu, Mg, Mn, B, Ti, Cr, etc. Large used alloys are $ATSi_9Cu_2MgB$ and $ATSi_{10}MgMn$ but with the shortcoming technology and mechanical properties, has been necessary to find a "universal" cast alloy that has proven to be $ATSi_9Cu_3MgMnB$, which is studied in this paper and responded well to the demands of constructors and technologists requirements of the non-ferrous foundries.

■ Keywords:

alloy, aluminium, thermal engine, pistons, casting

■ INTRODUCTION

In automotive industry is good to have a cast aluminium alloy (AAT) which correspond to the requirements of foundries technology, to have high mechanical strength both at ambient temperature and at high temperatures (resistance duration), dimensional stability over time, regardless of operating conditions, etc.

For developing (creating) a new alloy (made of AAT), with high technological and mechanical proprieties called UNIVERSAL DESTINATION Alloy, the basis for it had in mind the following considerations [1]...[4]:

1. Si content should be around 8-10%, to ensure high casting properties, which allow casting of PT by any method (in FAF, in shell, with lost models (fusible), centrifugal, under low or high pressure, etc.) without appear casting cracks.
2. Solid solution α must have a high quality of supersaturate in Ea, to allow during the aging process to obtain a high density of

ultra-dispersed particles (micro-heterogeneous) inside s.s. α grains. This allows achieving high flow limits and mechanical resistance.

3. Alloy components -Ea- and inclusion, in the alloy crystallization should not form particles occur on the separation of the s.s. α . [5]... [7].

Following research [1], [2] developed a new alloy cast in AAT, which possesses a chemical composition (8-11%Si; 3-4%Cu; 0.13-0.35%Mg; 0.1-0.3%Mn; 0.01-0.1B; 0.4%Fe, rest aluminium) and notes $ATSi_{9,5}Cu_3MgMnB$. Alloy has received a fast use at casting the various PT. In figure 1 (2.78) is shown typical PT, cast of this alloy, pieces that once was made by plastic deformation with very high costs.

To note that the proportion of Mg and Cu content in this alloy is other compared to $ATSi_9Cu_2MgB$. That alloy has characteristics of resistance much higher, both at ambient temperature and at higher temperatures. The complex configuration of PT and walls thickness,

and the operation of the PT must be considered on load composition of the alloy development. As before, the highest is Si content (but $Si < 12\%$), the greater is eutectic quantity, this means that has highest properties of casting and PT hermetically. However, with increasing Si content of alloy increases the tendency towards abortion gas, therefore PT is formed in a high porosity. For casting the complexity PT (complex configuration), with wall thickness 3-4mm is sufficient for the load to be 9% Si.

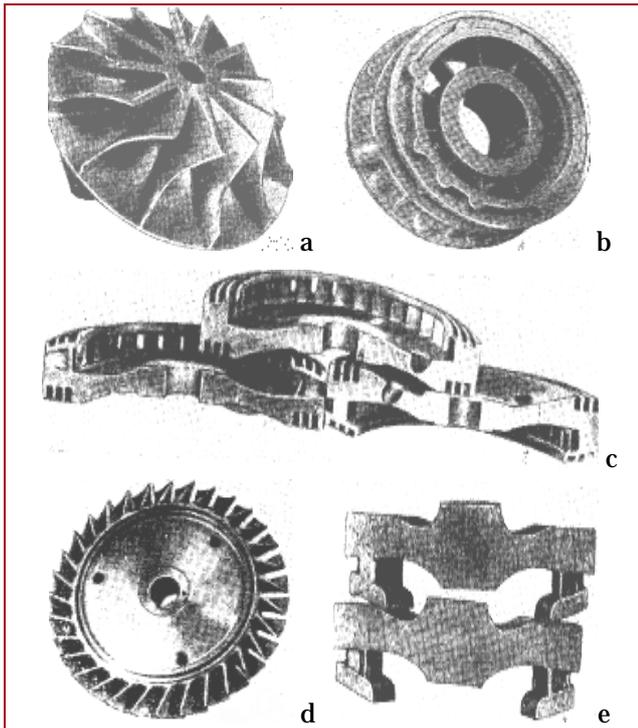


Fig.1 Pieces of great complexity cast of polynar alloy $ATSi_{10}Cu_3MgMnB$: a- centrifugal; b- precision; c- section of the turbine body; d- Precision; e- Shell (microstructure)

With increasing content of Cu, refractory alloy increases, but plasticity (A) decreases at ambient temperature. If the PT in this alloy is intended to work long time at high temperatures the content that should be at upper limit, and if working at ambient temperature, then at lower limit.

The increasing of Mg content leads to increase refractory alloy, but decreases plasticity at ambient temperature. To increase plasticity, in PT, the content of Mg should be kept at the lower limit, same for Fe content. In this situation the content of Mn should be 0.8% and the content of Fe = 0.2-0.3%.

If PT is accomplished by stamping of semi liquid state, then permitted Fe inclusion even 0.4%. This has a great technical and economic

meaning, because in the use of Al load (waste) technical with high content of Fe.

Ti and B are introduced in the alloy as modifier.

■ **$ATSi_9Cu_3MgMnB$ ALLOY STRUCTURE**

The alloy $ATSi_9Cu_3MgMnB$ as you can see possesses a complex chemical composition. Depending on the chemical composition fluctuation, Fe content in the PT and the rate of crystallization, phases of the alloy composition may change strongly. Alloy structure in a cast (especially in parts of the massive and high content of Cu) may have the following phases: α , Si, Mg_2Si , $CuAl_2$, $AlSiMnFe$ (figure 2, (2.79)). In case of very slow crystallization (at $T \approx ct$, in equilibrium) can form $W(Al_xMg_ySi_4Cu_4)$ phase which is seen in figure 3 (2.80).

Taking into account that in the $ATSi_9Cu_3MgBTi$ alloy can be eutectic with different melting temperatures (because of the complexity phase component, which depends on the rate of crystallization) and also considering the differential thermal analysis (figure 4 (2.81)) for PT is recommended two regimes of hardening:

- ⚡ heating at $500^\circ C/4h + 515^\circ C/10h$ followed by cooling in water temperature $20-30^\circ C$;
- ⚡ heating at $490^\circ C/4h + 500^\circ C/4h + 515^\circ C/6h$ and cooling in water temperature $20-30^\circ C$.

The first hardening regime is recommended to PT in the shell or PT with thin walls cast in FAT (when the cooling rate of casting is great - $v_{cr} >>> 0$). The second hardening regime is recommended for large size PT with thermal node (joints massifs).

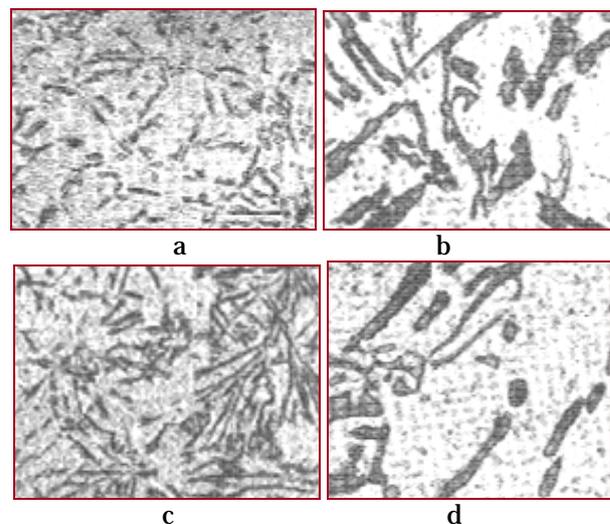


Fig.2 $ATSi_9Cu_3MgMnB$ alloy structure: a- cast (100:1); b- cast (500:1); over TT; c- 100:1; d- 500:1



Fig.3 Type of crystallization phase $W(Al_xMg_5Cu_4Si_4)_1a$ 500:1

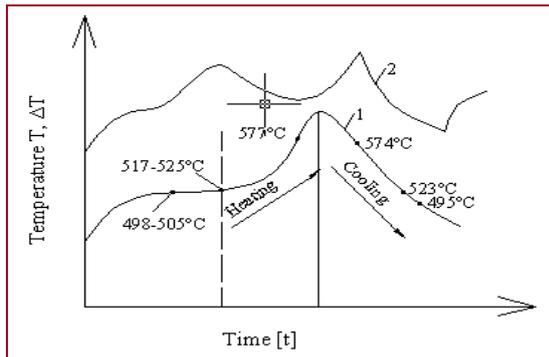


Fig.4 Direct thermal analysis curves (1) and differential (2) of the $ATSi_9Cu_3MgBTi$

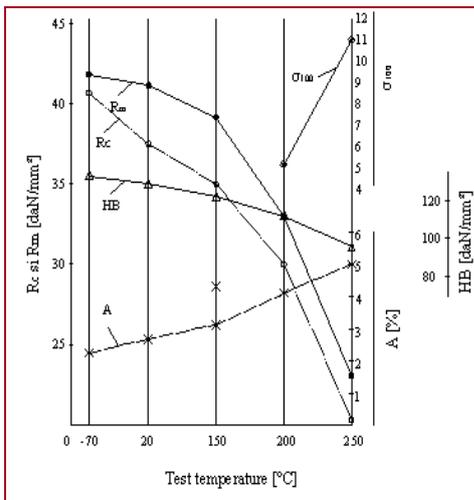


Fig.5 $ATSi_9Cu_3MgMnB$ proprieties determined on sample of $\Phi 12mm$ cast in shell

Mechanical properties of $ATSi_9Cu_3MgMnB$ hardening after the first regime and the aging after the regime $165^\circ C/22h$ or $175^\circ C/7h$, with air cooling are shown in figure 5 (2.82). At $20^\circ C$ has $HB=120daN/mm^2$ and decrease with test temperature increase.

CONCLUSIONS

The physical properties of the alloy $ATSi_9Cu_3MgMnB$ practically are the same as those of the alloy $ATSi_9Cu_3MgB$, and the casting

of the alloy as $ATSi_{10}MgMn$. The cutting process is better [5], than the two mentioned alloys. The welding is good.

To confirm the correctness of the choice of aging regime is shown in figure 6 (2.83) s.s.α alloy structure $ATSi_9Cu_3MgMnB$ in hardening state and cast in forms of mixture formation.

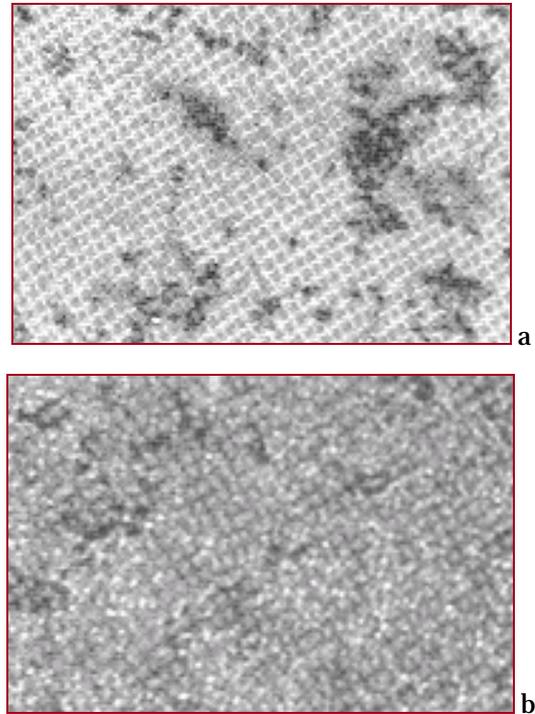


Fig. 6 $ATSi_9Cu_3MgMnB$ structure alloy in hardening state after casting in: a- FAT and b- shell (10000:1)

Note that the cooling was the first stage of aging, this mean that, they have managed to form ZGP and agglomerations of Si ultra-dispersed particles what were separately from s.s.α. In comparing these pictures, you can see that ZGP density in solid solution alloy $ATSi_9Cu_3MgMnB$, cast in FT, is much reduced, comparative to s.s.α of the alloy cast in shell. This can be explained by the fact that: supersaturate degree of s.s.α in the last sample, in all probability, is higher, and the degree of distortion R_c of s.s.α also higher, which accelerates the process of form ZGP, and ultra-dispersed particle of elementary Si.

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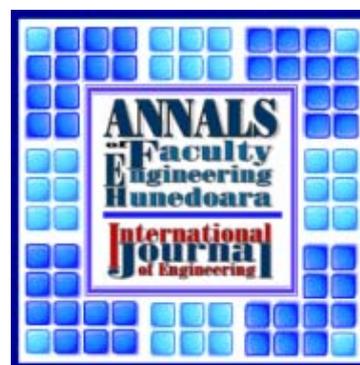
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CONSIDERATIONS REGARDING THE TESTING OF ELECTRICAL APPARATUS WITH THE TYPE OF PROTECTION “INCREASED SAFETY”

■ **Abstract:**

Increased safety “e” represent a type of protection applied to electrical apparatus in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service or under specified abnormal conditions.

■ **Keywords:**

type of protection, increased safety, type tests

■ **GENERALITIES**

Evaluation and testing of equipments that compose an explosion-proof system, in purpose of certification, is very important considering the existing explosion risk which has to be minimized to ensure peoples health and security, as well as to prevent goods damage and, not in the last instance, to protect the environment.

The type of protection increased safety “e” applies to electrical apparatus with a rated value of supply voltage not exceeding 11 kV r.m.s. a.c. or d.c. Additional measures are applied to ensure that the apparatus does not produce arcs, sparks, or excessive temperatures in normal operation or under specified abnormal conditions.

The principle for the type of protection increased safety is represented by carefully choose of the materials used for construction of such kind of apparatus, assurance of certain clearances and creepage distances in such manner that the probability of a failure to occur

and to result an electric arc or spark to be reduced at an acceptable level; as well as to ensure an adequate degree of protection for the apparatus enclosure.

For the certification of electrical apparatus with type of protection increased safety, this should be submitted to type tests and routine tests.

In the type tests category are included the tests to determine the maximum surface temperature (to include the apparatus in a certain temperature class), tests for resistance to impact, dielectric strength test, tests for degree of protection (IP) and, if necessary, tests for thermal endurance to heat and cold, resistance to light, resistance to chemical agents and other tests which are specific for different types of apparatus.

The tests for thermal endurance to heat and cold, determination of surface temperature for luminaries and electric motors; and determination of time t_F for electrical rotating machines now can be done at INCD-INSEMEX. The apparatus needed to run these tests was in part acquired with funds from National

Authority for Scientific Research in the Nuclear Program.

TESTS FOR THERMAL ENDURANCE TO HEAT AND COLD

The thermal endurance to heat shall be determined by submitting the enclosures or parts of enclosures in non-metallic materials, on which the integrity of the type of protection depends, to continuous storage for four weeks at $(90 \pm 5) \%$ relative humidity at a temperature of $(20 \pm 2) K$ above the maximum service temperature, but at least $80^\circ C$.

In case of a maximum service temperature above $75^\circ C$, the period of four weeks specified above shall be replaced by a period of two weeks at $(95 \pm 2)^\circ C$ and $(90 \pm 5) \%$ relative humidity followed by a period of two weeks in an air oven at a temperature of $(20 \pm 2) K$ higher than the maximum service temperature.

The thermal endurance to cold shall be determined by submitting the enclosures and parts of enclosures of non-metallic materials, on which the type of protection depends, to storage for 24 h in an ambient temperature corresponding to the minimum service temperature reduced by at least 5 K but at most 10 K.



Figure 1. Control and monitoring panel for climatic chamber Vötsch, type VC 7060

The test rig designed for these tests consists in a climatic chamber Vötsch type VC 7060, having a capacity of $0,6 m^3$, and the temperature can be adjusted in the range $-70 \div +180^\circ C$. The result of test is considered positive if the exposed apparatus shows no deteriorations that affect the type of protection.

TEST OF ROTATING ELECTRICAL MACHINES. DETERMINATION OF TIME, t_E

Time t_E represents the time taken for an a.c. rotor or stator winding, when carrying the initial starting current I_A , to be heated up to the limiting temperature from the temperature reached in rated service at the maximum ambient temperature.

The diagram illustrating determination of time t_E is given in figure 2.

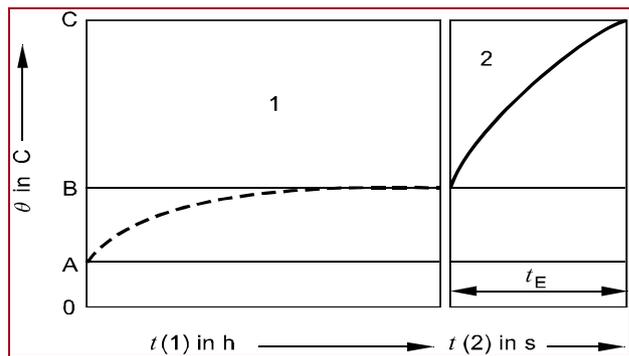


Figure 2 – Diagram illustrating the determination of time t_E

Key: A Highest permissible ambient temperature
 B Temperature in rated service; C Limiting temperature;
 t Time; θ Temperature; 1 Temperature rise in rated service; 2 Temperature rise during stalled rotor test

The temperature rise in stalled motors shall be determined experimentally as follows:

- ✚ With the stalled motor initially at ambient temperature, rated voltage and rated frequency shall be applied.
- ✚ The stator current measured 5 s after switching on shall be considered to be the starting current I_A .
- ✚ The temperature rise in the rotor cage (bars and rings) shall be measured by thermocouples and measuring instruments having a small time constant compared with the rate of temperature rise, or by temperature detectors or other means. The highest of the temperatures obtained during these measurements is the one to be considered.
- ✚ The average temperature rise of the stator, determined from resistance measurements, is taken as the temperature rise of the winding.

When the stalled motor test is made at a voltage less than rated voltage, the measured values shall be increased proportionally to the ratio of those voltages, directly for the starting current

and according to the square of the temperature rise. Saturation effects, if any, shall be taken into account.

The block diagram for the test rig used to determine time t_F is given in figure 3. To fulfil the test rig the following apparatus was acquired: power analyzer Fluke 435, milliohmmeter Cropico DO5001, data acquisition system Agilent 34970A with thermocouples, laptop Dell Latitude D830.

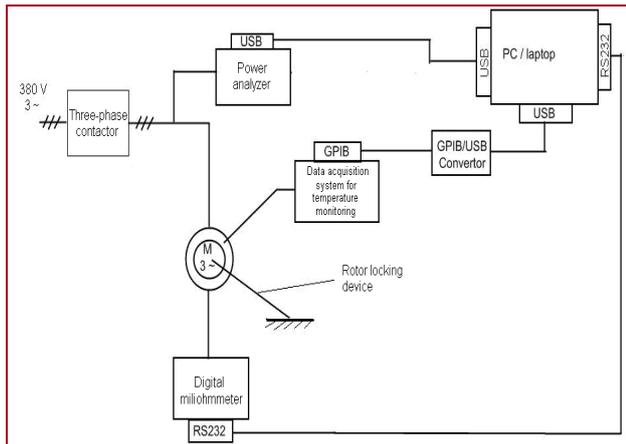


Figure 3. Block diagram of the test rig used to determine time t_F

The role of Fluke 435 power analyzer is to measure and record the important parameters (voltage, current, frequency, power factor, etc.) during the test.

The Cropico DO5001 milliohmmeter measure and record the values for the stator winding resistance in cold state and after the test.

The data acquisition system Agilent 34970A with thermocouples is used to measure and monitor temperature during test.

DETERMINATION OF MAXIMUM SURFACE TEMPERATURE FOR ELECTRICAL ROTATING MACHINES

In order to determine the maximum surface temperature the following apparatus is used: power analyzer Fluke 435, milliohmmeter Cropico DO5001, data acquisition system Agilent 34970A with thermocouples, tachometer Lutron L1236L, laptop Dell Latitude D830.

To determine the maximum surface temperature the following steps should be covered:

- build-up experimental mounting according block diagram from figure 4, and connect the electric motor to adjustable load test rig;

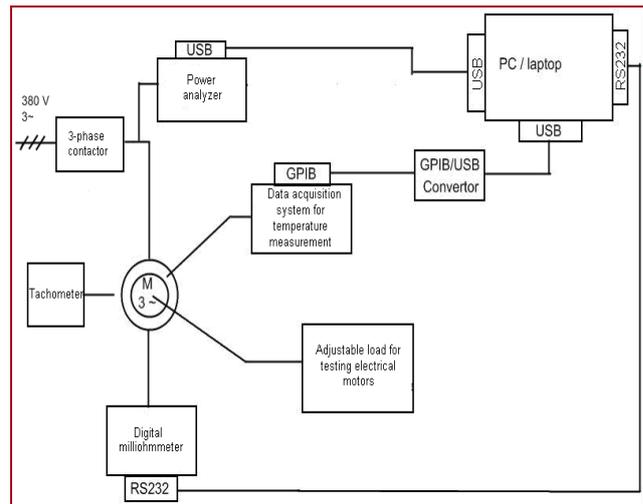


Figure 4. Test rig to determine maximum surface temperature for electrical rotating machines

- the stator winding resistance is measured and recorded, in „cold” state, with the help of Cropico DO 5001 microohmmeter;
- the thermocouples connected to Agilent 34970A data acquisition system are placed in points considered to be the hottest points during motor running;
- the adjustable load test rig is powered-on and the electric motor is driven on low speed;
- the electric motor is powered-on through a 3-phase contactor;
- the load is adjusted until the motor speed reaches nominal speed (rotation speed is measured with the help of Lutron 1236L tachometer);
- in this configuration, the system will function until the maximum temperature in normal functioning is reached, according SR EN 60079-0 and SR EN 60079-7 (temperature rising is lower than 2 K/hour);
- after reaching the maximum surface temperature, the motor is powered-off and the adjustable load rig is driven so as to give a quick stop of the motor.
- the stator winding resistance is measured and recorded, with the help of Cropico DO 5001 microohmmeter;

The rotor temperature is measured with thermocouples placed on the rotor through some holes affected in the drive-part shield. Delay time after power-off to determine overtemperature in rated service is presented in table 1.

Table 1: Delay time after power-off required to determine temperature in rated service

Rated power, (kW)/(kVA)	Delay time after power-off, (s)
$P \leq 50$	30
$50 < P \leq 200$	90
$200 < P \leq 5000$	120

Temperature and winding resistance recording is made for at least 2 minutes after motor power-off, in reason to set-up the cooling curve for rotor and stator winding.

Data referring to electrical parameters during test (voltage, current, frequency, power factor, etc.) are viewed and recorded through the power analyzer, and transferred to a PC after the test.

The maximum temperature reached in stator winding at rated service is determined with the following formula:

$$\theta_2 = \Delta\theta + \theta_a$$

where

$$\Delta\theta = \frac{R_2 - R_1}{R_1} \times (k + \theta_1) + \theta_1 - \theta_a$$

R_1 – winding resistance value in cold state, in Ω ;
 R_2 – winding resistance value in warm state, in Ω ;

θ_1 – winding temperature value in cold state, in $^{\circ}\text{C}$;

θ_2 – winding temperature value after heating test, in $^{\circ}\text{C}$;

θ_a – temperature value for the cooling environment (ambient);

k – reciprocal temperature coefficient for resistance at 0°C for conductive material; $k = 235$ – for copper; $k = 225$ for aluminium;

T_{amb} – maximum ambient temperature (generally 40°C);

The maximum surface temperature is determined as the temperature measured in the hottest point of the motor, with the following formula:

$$T_{max} = T_{amb} + \Delta\theta$$

in this case $\Delta\theta$ represents the highest rise of temperature (measured in points where the thermocouples were placed).

DETERMINATION OF MAXIMUM SURFACE TEMPERATURE FOR LUMINAIRES DESIGNED FOR MAIN SUPPLY

In order to determine the maximum surface temperature for luminaires the following apparatus is used: ac power source Kikusui type PCR 1000M, data acquisition system Agilent 34970A with thermocouples, laptop Dell Latitude D830.

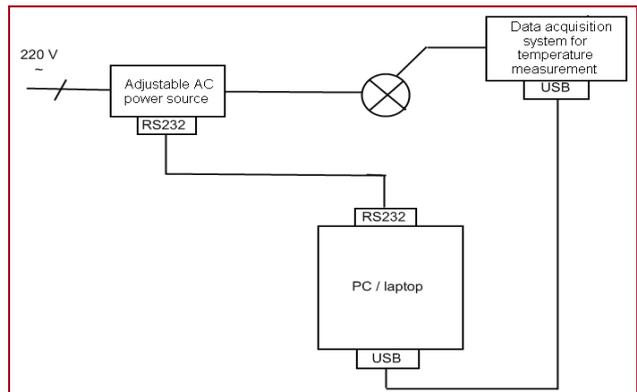


Figure 5. Test rig to determine maximum surface temperature for luminaires designed for main supply

To determine the maximum surface temperature of luminaires designed for main supply the following steps should be covered:

- ✚ build-up experimental mounting according block diagram from figure 5;
- ✚ the thermocouples connected to Agilent 34970A data acquisition system are placed in points considered to be the hottest points during functioning.
- ✚ for tubular fluorescent lamps with main supply a diode will be connected in series with the lamp, and the luminaire supplied with a voltage equal to 110% of rated voltage;
- ✚ the luminaire is powered-on through Kikusui PCR 1000M ac power supply at voltage and frequency required by standard;
- ✚ in this configuration, the all system will function until the maximum temperature in normal functioning is reached (temperature rising is lower than 2 K/ hour). The temperature is monitored by data acquisition system Agilent 34970A with thermocouples;
- ✚ when thermal equilibrium is reached the ac power source output of powered-off, and the data corresponding to electrical parameters during test are saved on PC;
- ✚ after approximately 1 minute from power-off the ac power source output the temperature

recording is stopped and the data is saved on computer;

- ✦ the maximum surface temperature is determined with the following formula:

$$t_{max} = t_{inc} + (t_{amb\ max} - t_{amb\ inc})$$

where:

t_{inc} – temperature recorded during test (°C) in the hottest spot;

$t_{amb\ max}$ – maximum ambient temperature to which the equipment is designed to work;

$t_{amb\ inc}$ – ambient temperature during test;

In the end of the test, the temperature should not exceed the temperature specified for the specific temperature class (80 °C for T6, 95°C for T5, 130°C for T4, 195°C for T3). The temperature at the rim of the lamp cap and at the soldering point of the lamp cap shall not exceed the limiting temperature.

CONCLUSIONS

The purpose of the paper is to underline the new test that can be done at INCD INSEMEX Petrosani for electrical apparatus with increased safety „e” type of protection. These tests are: thermal endurance to heat and cold, determination of surface temperature for luminaries and electric motors; and determination of time t_E for electrical rotating machines. The apparatus needed to run these tests was in part acquired with funds from National Authority for Scientific Research in the Nucleu Program.

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YIELD FACTORS OF A PHOTOVOLTAIC PLANT

■ Abstract:

The paper gives the definition of the main yield factors that characterizes the performances of a photovoltaic plant. This are analyzed for a grid connected photovoltaic plant at the University in Resita, in use since spring 2008, were the main climatic and technique parameters of the photovoltaic plant are monitorised and heaped in an data base for further analysis.

■ Keywords:

yield factors, photovoltaic plant, photovoltaic system

■ INTRODUCTION

Accurate and consistent evaluations of photovoltaic (PV) system performance are critical for the continuing development of the PV industry. These performance parameters allow the detection of operational problems; facilitate the comparison of systems that differ with respect to design, technology or geographic locations.

■ SPECIFIC YIELD FOR SOLAR PHOTOVOLTAIC PLANTS

Parameters describing energy quantities for the PV system and its components have been established by the International Energy Agency (IEA) Photovoltaic power System Program and are described in the IEC standard [1]. The generally definition of yield factors of power plants, expressed in simplified terms, describes how many times energy generated during plant operation covers the energy used for constructing the plant. An exact definition would be: The yield factor is the ratio of net energy production during plant life and the

cumulative energy used for construction, operation and operating supply items¹. This concept is only meaningful in the context of using regenerative energy sources, as photovoltaic plants, insular ore grid connected.

Three of the IEC standard 61724 performance parameters [2] may be used to define the overall system performance with respect to the energy production, solar resource and overall effect of system losses. These parameters are the performance ratio, final PV system yield and reference yield.

The final PV system yield Y_f is the net energy output E_{PV} divided by the nameplate d.c power $P_{maxG,STC}$ (STC – Standard Test Condition 1000 W/m², 25°C) of the installed PV array. It represents the number of hours that the PV array would need to operate at its rated power to provide the same energy. The units are hours or kWh/kW:

$$PR = \frac{AC - GridinjectedEnergy}{PVSystemEnergyInSTC} \quad (1)$$

The Y_f normalizes the energy produced with respect to the system size, being a convenient

way to compare the energy produced by PV systems of differing size.

The specific plant losses are described through L_c - capture losses, losses that are caused by obfuscation, temperature grown, mismatching, limitation through dust, losses generated by energy conduction in the photovoltaic modules and L_s - system losses, caused by inverter, conduction and losses of passive circuit elements.

The reference yield Y_r is the total in-plane irradiance H divided by the PV's reference irradiance G . It represents the under ideal conditions obtainable energy. If G equals 1 kW/m^2 , then Y_r is the number of peak sun hours or the solar radiation in units of kWh/m^2 . The Y_r defines the solar radiation resource for the PV system. It is a function of the location, orientation of the PV array, and month-to month and year-to-year whether variability.

$$Y_A = \frac{E_{PV}}{P_{\max G,STC}} \quad (2)$$

To compare on different locations mounted grid connected PV systems, the performance ratio is a decisive value [2]. The performance ratio is the Y_f divided by the Y_r . By normalizing with respect to irradiance, it quantifies the overall effect of losses on the rated output due to: inverter inefficiency, wiring, mismatch and other losses when converting from d.c. to a.c power, PV module temperature, incomplete use of irradiance by reflection from the module front surface, soiling or snow, system down-time and component failures.

$$Y_f = \frac{E_{PV,AC}}{P_{\max G,STC}} \quad (3)$$

Performance ratio PR values are typically reported on a monthly or yearly basis. Values calculated for smaller intervals, such as weekly or daily, may be useful for identifying occurrences of component failures. Because of losses due the PV module temperature, PR values are greater in the winter than in the summer and normally fall within the range 0.6 to 0.8. If the PV module soiling is seasonal, it may also impact differences in PR from summer to winter. Decreasing yearly values may indicate a permanent loss in performance. Considering the increasing

degree of effectiveness, the performance ratio PR factor can reach ideal annual values between 0.8 and 0.84.

The PR being a dimensionless quantity that indicates the overall effect of losses [5] on the rated output, does not represent the amount of produced energy, because a system with low PR in a high solar resource location might produce more energy than a system with a high PR in a low solar resource location. However, for any given system, location and time if a change in component or design increase the performance ratio PR, the final yield Y_f increase accordingly. PR values are useful for determinations if the system is operating as expected. Large decrease in PR indicates events that significantly impact performance, such as inverters not operating or circuit-breaker trips. If the PR decrease moderate or small, it indicates that a less severe problem exists. The performance ratio PR can identify the existence of a problem, but not the cause. To identify the cause of the existing problem, a research at the site is needed.

■ GRID CONNECTED PHOTOVOLTAIC PLANT AT THE UNIVERSITY 'EFTIMIE MURGU' RESITA

The grid connected photovoltaic system [3] mounted at the 'summer theater' of the University 'Eftimie Murgu' Resita, since middle of may 2008, is putted together from four high performance standard solar modules of type Multisol 150, manufactured by Scheuten Solar – Germany [6], with a total capacity of 600W/h. The system is completed with a Sunny Boy 1100 inverter and a completely online monitoring system of the PV, made from a Sunny Webbox and the Sunny Sensorbox. This monitoring system [4], build up like in figure 1, allows a detailed supervision of the PV plant, produced energy, measuring and saving values of solar radiation, ambient and module temperature, wind speed and direction.

The measured values and the current energy yield are visualized and archived in the Internet, through the sunny web portal [7], figure 2.

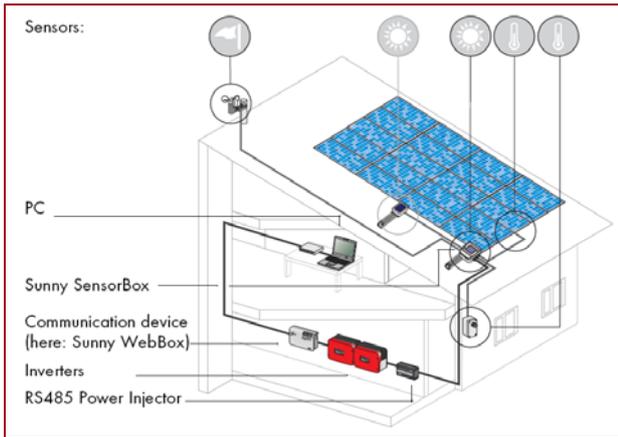


Figure 1 Complete scheme, photovoltaic and monitoring system

SPECIFIC YIELD FOR THE SOLAR PHOTOVOLTAIC GRID CONNECTED SYSTEM AT THE EFTIMIE MURGU UNIVERSITY

This paragraph allows us an overview of the specific yield factor Y_A for the grid connected photovoltaic system, for a time period of almost one year, from middle of May 2008 until the end of March 2009.

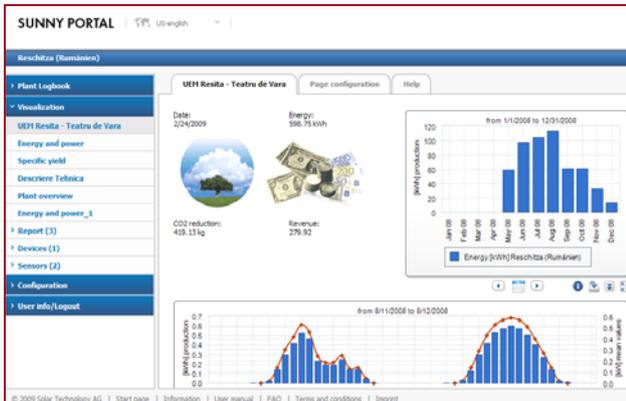


Figure 2 Sunny web portal on-line monitoring

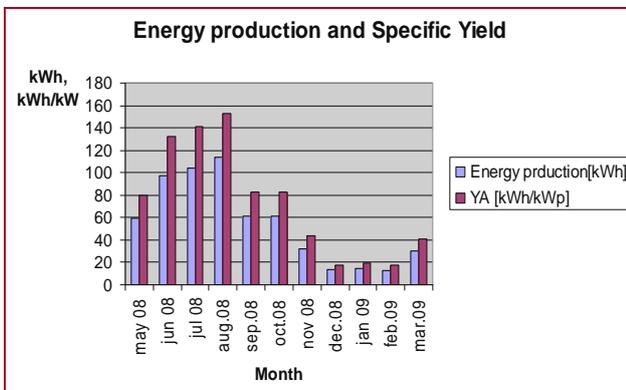


Figure 3. Energy production and array yield

Figure 3 represents the energy production and the specific yield factor for this period. A more

detailed, daily, overview of the yield factor in the analyzed period is given in table 1.

Table 1 Daily Specific Yield Factor

	Specific Yield Factor - Y_A [kWh/kWp]										
	may 2008	jun. 2008	jul. 2008	aug. 2008	sept. 2008	oct. 2008	nov. 2008	dec. 2008	jan. 2009	febr. 2009	mart. 2009
1	0,00	4,72	5,78	6,49	5,65	4,64	1,57	2,30	0,12	2,32	0,00
2	0,00	5,15	5,99	5,80	4,54	1,59	1,61	1,84	0,00	1,69	0,03
3	0,00	6,11	5,76	5,69	5,39	3,80	2,68	0,27	0,22	0,85	1,31
4	0,00	5,22	4,96	5,61	5,18	2,43	2,28	0,51	0,24	1,15	3,62
5	0,00	3,65	3,92	5,81	5,24	0,12	1,12	1,68	0,24	0,97	1,05
6	0,00	2,12	6,08	6,28	5,68	2,51	1,70	0,16	0,77	3,26	4,73
7	0,00	1,78	5,80	5,78	4,82	2,89	2,35	0,12	2,16	2,66	0,30
8	0,00	2,16	4,51	5,76	2,97	2,54	1,24	0,38	0,01	1,89	0,39
9	0,00	2,45	4,95	2,46	5,73	2,09	1,66	0,49	0,64	0,09	3,11
10	0,00	1,96	3,22	4,81	5,28	2,88	2,95	1,74	1,11	1,93	1,61
11	0,00	5,34	5,99	4,73	3,82	3,89	2,69	0,85	0,38	0,32	2,53
12	0,00	4,46	5,81	6,08	3,86	4,27	2,53	0,19	1,07	0,00	0,97
13	0,00	3,88	5,65	5,86	0,82	3,59	2,36	0,54	0,76	0,00	0,72
14	0,00	2,96	4,61	5,28	1,07	2,09	1,28	1,73	0,65	0,00	3,95
15	1,58	2,32	1,15	5,85	0,15	3,50	2,30	1,24	0,22	0,00	6,35
16	5,59	5,27	3,53	4,95	0,69	3,59	2,36	0,88	0,08	0,00	0,50
17	4,88	5,70	5,11	5,28	0,57	0,12	0,20	0,89	1,70	0,00	0,80
18	5,39	3,41	4,97	6,14	0,35	4,23	1,27	0,05	2,57	0,00	0,24
19	4,70	3,41	5,93	6,23	1,07	3,64	0,39	0,12	2,03	0,00	3,11
20	5,24	5,36	6,12	5,97	0,55	3,89	2,24	0,08	2,32	0,00	4,77
21	3,72	5,89	5,08	5,57	0,69	3,62	0,09	0,11	0,45	0,00	1,85
22	0,76	6,00	0,51	4,45	1,64	3,61	0,38	0,49	0,80	0,00	5,15
23	4,85	1,89	1,23	4,26	3,14	3,43	0,14	0,15	0,46	0,00	0,00
24	6,62	5,58	2,19	1,89	2,51	0,18	0,95	1,70	0,22	0,00	0,00
25	4,74	5,84	1,11	4,53	0,64	0,30	0,16	0,01	0,31	0,00	0,00
26	5,05	5,70	2,70	6,18	0,80	0,64	0,04	0,08	0,20	0,00	0,00
27	5,85	5,20	6,09	3,89	0,58	3,39	0,77	0,04	0,95	0,00	0,00
28	5,73	1,76	5,11	3,59	1,73	3,20	1,88	0,05	0,08	0,00	0,00
29	6,08	5,95	5,70	1,26	2,66	1,76	1,18	0,00	0,09	0,00	0,00
30	5,59	6,03	6,14	3,97	4,89	1,15	2,57	0,01	0,18	0,00	0,00
31	5,32	0,00	6,14	5,23	0,00	3,15	0,00	0,01	0,55	0,00	0,00

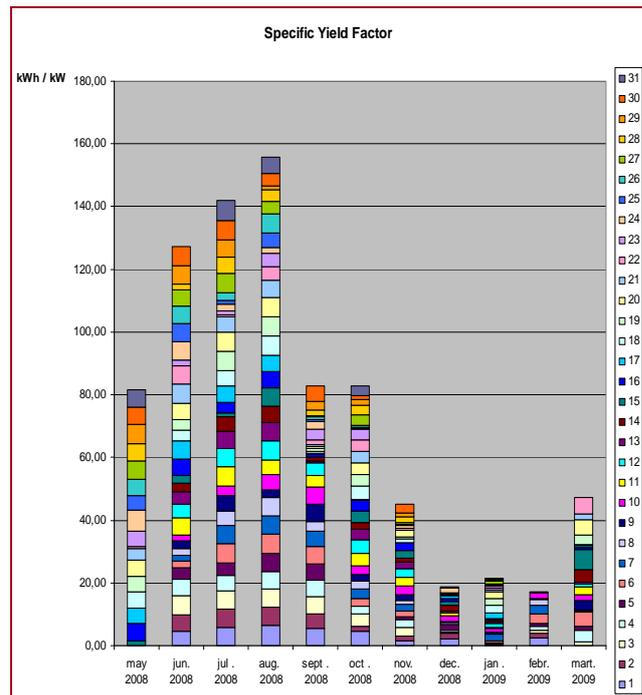


Figure 4 Daily yield factor, May 2008 – March 2009

CONCLUSIONS

Analyzing the specific yield factor, the photovoltaic plant owner can have a permanent look of the time, in hours expressed, that the system works in STC and obtains indicate or a higher energy

production. As shown, during summer the yield factor has a much higher density in June, July and August and the lowest in December, January and February.

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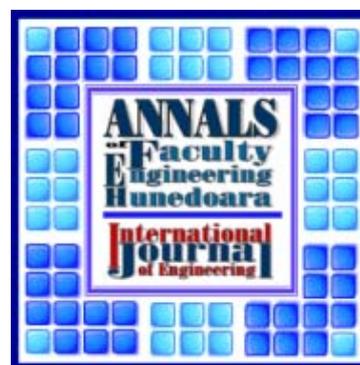
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COMPUTER SIMULATION OF THE TRANSIENTS IN ASYNCHRONOUS MACHINES IN THE CASE OF SHORT-CIRCUIT AND CONNECTION TO NETWORKS

■ **Abstract:**

The mathematical models of the Asynchronous Electrical machines developed on the basis of the experimental frequency-response characteristics are proposed in this paper. The latter ones are recommended for investigating the transient processes occurring at short-circuits and connections of the electrical machines to the bus bars of electrical system taking account of their rotor speed changes.

■ **Keywords:**

Asynchronous machines, frequency-response, networks connections, short-circuit

■ **INTRODUCTION**

It is a matter of familiar experience that the methods of frequency-response characteristics [1, 2, 8, 9, 13 and 14] have received wide acceptance in the scientific-research and engineering practical activity for investigating and evaluating the transient conditions of the AC machines in electrical systems. The above mentioned methods make possible to carry out the direct application of the experimental initial data in the form of frequency-response characteristics of the separate electrical system elements or of the system as a whole. Such an approach, in the special cases that the system internal structure is indeterminate, has much potential for yielding the more precise calculations of the transient processes.

The calculation technique for determining the transients by the use of the frequency-response characteristics of synchronous machine stator admittance in the direct, $Y_d(js)$, and quadrature, $Y_q(js)$, axes or the circle diagram of an induction motor was proposed in [1,2,3 and 4]. The

graphic-analytical methods for determining the armature current and electromagnetic torque of the synchronous machine were developed in the cited monograph too. The methods being considered allow carrying out more accurate calculations of the transient processes taking into account the following characteristic features

- *electromagnetic asymmetry of the rotor;*
- *representation of the turbogenerator solid rotor by means of the equivalent circuits corresponding to the high order transfer function of the damper system;*
- *current displacement in the windings of electrical machines;*
- *saturation phenomenon in the main and leakage paths of the magnetic fluxes of the AC machines;*
- *external impedance inserted in the armature winding of the AC machine.*

The above mentioned methods did not get wide dissemination in due course though.

The great amount of information on the frequency-response characteristics of the

synchronous machines and induction motors compiled by now and availability of the developed method designed for synthesising the equivalent circuits adequately reflecting the initial frequency-response characteristics of the AC electrical machines open up fresh opportunities for improving and further development of the frequency-response methods for investigating the transients in electrical machines.

The objective of the paper is to develop the mathematical models of the AC machines based on the experimental frequency-response characteristics for investigating the transients at short-circuits and connections of the AC machines in electrical system taking into consideration the occurring speed changes of the AC machine rotor.

BASIC RELATIONS

The mathematical relations realising the graphic-analytical approach [1,2 and 3] to determining the components of the stator phase current and electromagnetic torque at short-circuits or connections of the synchronous machines rotating at the synchronous speed to the electrical system are obtained in [5, 10, 11 and 18]. When the machine with the rotor asymmetry operates at the short-circuit with the speed changes relative to the synchronous speed or it is connected to the network at the given slip, determining the components of the generalised stator current vector is carried out in the following way:

We find the average value of the steady-state current $I_{s0,av}$ for the s at the first instant of the transient process

$$I_{s0,av} = Y_{av}(js)_{s0} \tag{1}$$

where
$$Y_{av}(js) = \frac{Y_d(js) + Y_q(js)}{2}$$

We determine the pulsating component of the steady-state current

$$\Delta I_{s0} = (R_e [\Delta Y(js)_{s0}] - j \text{Im}[\Delta Y(js)_{s0}]) \cdot e^{-j2\delta_0} \tag{2}$$

where

$$\Delta Y(js) = \frac{Y_d(js) + Y_q(js)}{2}, \quad \delta_0 = \text{angle between}$$

The q -axis of the rotor and the voltage vector at the infinite bus of an electrical system;

We find the changes in the steady-state current with time, taking into account the difference in the rotor parameters on axes of its electrical and magnetic symmetry,

$$I_{s0}(t) = (I_{s0,av} + \Delta I_{s0} e^{-j2st}) \cdot e^{j\omega_n t} \tag{3}$$

We determine the aperiodic current component

$$I_{s1,av} = Y_{av}(js)_{-(1-s)} \tag{4}$$

And the periodic current of the frequency close to the doubled one

$$\Delta I_{s1} = (\text{Re}[\Delta Y(js)_{-(1-s)}] j \text{Im}[\Delta Y(js)_{-(1-s)}]) \cdot e^{-j2\delta_0} \tag{5}$$

Aperiodic current and the current component caused by the rotor asymmetry are changed in accordance with the following expression

$$I_{s1}(t) = -[I_{s1,av} \cdot e^{j\omega_n \cdot \omega_n t} - \Delta I_{s1} \cdot e^{j2(1-s-\omega_n)\omega_n t}] \cdot e^{-t/\tau_a} \tag{6}$$

The natural angular frequency of the aperiodic current vector, ω_n and the time constant of its decaying, τ_a , are defined for the average complex admittance $Y_{av}(js)$ at the slip $s = -(1-s)$ by equations

$$\omega_n = \text{Im}[Y_{av}(js)_{s=-(1-s)}] \cdot R_{s0} \tag{7}$$

$$\tau_a = \frac{1}{\omega_n = \text{Im}[Y_{av}(js)_{s=-(1-s)}] \cdot R_{s0} \cdot \omega} \tag{8}$$

The initial value of the periodic component of the transient current, I_{s2} is determined by recognizing that

$$I_{s0}(t)_{t=0} + I_{s1}(t)_{t=0} + I_{s2}(t)_{t=0} = 0$$

Generally, the initial value of the current vector $I_{s2}(t)_{t=0}$ does not coincide with the d -axis of a rotor (including the connections of the synchronous machine occurring at the angle ($\delta_0 = 0$)) resulting in aperiodic current components in both axes of the rotor symmetry. Implementation of the method proposed is associated with representing the initial frequency-response characteristics in the form of equivalent circuits in the d - and q -axis of a synchronous machine. The latter ones, e.g., the equivalent circuit in d -axis shown in Figure1 may be used for determining the changes in the periodic current components with time [6].

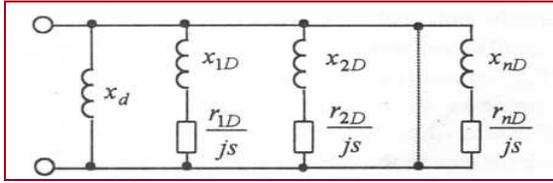


Figure 1. Equivalent circuit of the synchronous machine rotor in d-axis

The mentioned equivalent circuits allow to obtain the initial values ($I_{S2_{dk}}, I_{S2_{ql}}$) and the time constants (τ_{dk}, τ_{ql}) of the exponential components of the periodic armature current $I_{S2}(t)$. So in the d- and q-axis we have

$$\tau_{dk} = \frac{x_{kD}}{\omega \cdot r_{kD}}, I_{S2_{dk}} = \frac{1}{x_{kD}}, k = 1, 2, \dots, N; \quad (9)$$

$$\tau_{ql} = \frac{x_{lQ}}{\omega \cdot r_{lQ}}, I_{S2_{ql}} = \frac{1}{x_{lQ}}, l = 1, 2, \dots, M$$

From the above, it might be assumed that the time-dependence of the periodic current follows the law

$$I_{S2}(t) = \left(\sum_{k=1}^N I_{S2_{dk}} \cdot e^{-t/\tau_{dk}} \right) \cdot e^{j \cdot (1-S)\omega \cdot t} \cdot e^{j\delta_0} + \left(\sum_{l=1}^M I_{S2_{ql}} \cdot e^{-t/\tau_{ql}} \right) \cdot e^{j \cdot (1-S)\omega \cdot t} \cdot e^{j\delta_0} \quad (10)$$

Where N, M = quantity of the elementary equivalent circuits of the rotor in d- and q-axis, respectively.

In the general case the initial I_{S2} current components in the d- and q-axis should be converted in proportion to the projection of the I_{S2} current vector on the direct, I_{S2d} , and quadrature I_{S2q} rotor axes, e.g.,

$$I_{S2d} = \text{mod}[I_{S2}(t)_{t=0}] \cdot \cos(\varphi - \delta_0), \quad (11)$$

$$I_{S2q} = \text{mod}[I_{S2}(t)_{t=0}] \cdot \sin(\varphi - \delta_0)$$

Where φ = argument of the $I_{S2}(t)_{t=0}$ current vector (the angle between the current vector and the real axis of the complex plain).

Then

$$I_{S2_{dk}} = \frac{1}{x_{kD}} \cdot \frac{I_{S2d}}{\sum \frac{1}{x_{kD}}}, \quad (12)$$

$$I_{S2_{ql}} = \frac{1}{x_{lQ}} \cdot \frac{I_{S2q}}{\sum \frac{1}{x_{lQ}}}$$

The total generalized vector of the transient armature current comprises the vector sum of separate components:

$$I_S(t) = U \cdot [I_{S0}(t) + I_{S1}(t) + I_{S2}(t)] \quad (13)$$

Where V = voltage across the terminals of an armature winding at the short-circuit condition or connection of a synchronous machine to the network.

The instantaneous values of the phase currents are determined as a projection of the generalized current vector on the motionless time axes of the appropriate phases:

$$i_A(t) = \text{mod}[I_S(t)] \cdot \cos(\alpha(t) + \gamma_0),$$

$$i_B(t) = \text{mod}[I_S(t)] \cdot \cos(\alpha(t) + \gamma_0 - \frac{2}{3}\pi), \quad (14)$$

$$i_C(t) = \text{mod}[I_S(t)] \cdot \cos(\alpha(t) + \gamma_0 + \frac{2}{3}\pi)$$

Where $\alpha(t)$ = time-dependent argument of the total generalized vector of the armature current.

It is evident that the dynamic properties of an induction machine can be described in full measure by means of a single frequency-response characteristic $Y(js)$. In this case, the expressions obtained above will not contain the additional current components ΔI_{S0} and ΔI_{S1} there are no needs in decomposition of the I_{S2} current on the d- and q-axis components either [20, 21].

In accordance with the general approach the electromagnetic torque is determined using the current and flux linkage complexes, regardless of the rotor symmetry of the AC machine, by the expression:

$$T = \text{Re}[j\psi_s \cdot \dot{I}_s] = R_e[j(\psi_{S0} + \psi_{S1}) (\dot{I}_{S0} + \dot{I}_{S1} + \dot{I}_{S2})] \quad (15)$$

The magnetic linkages in (15) can be presented more detail as follows:

$$\psi_s = \psi_{S0} - \psi_{S1} = e^{j\omega t} - e^{j\omega_n t} e^{-t/\tau_a} \quad (16)$$

As may be seen from the equations (15) and (16), the electromagnetic torque can be presented as the sum of the vector products of the currents by flux linkage components. For example, the product of the vector I_{S0} by the vector ψ_{S0} produces the steady-state torque being numerically equal to the vertical projection of the current vector at the rated voltage across the terminals of the stator winding.

The influence of the separate current and torque components on the features of the transient process having been analyzed, it is possible to simplify the mathematical model of an electrical machine with the given accuracy.

At researching the electromechanical transients connected with the speed variations of AC machine rotor one should consider the simultaneous solution of the equations deduced above and the supplementary equation of the rotor relative motion. The latter one can be written in the following form:

$$M \frac{ds}{dt} = T - T_{\text{mech}} \quad (17)$$

Where T_{mech} = shaft torque developed by the prime mover; M = inertia constant.

THE PARAMETERS OF THE ALGORITHM

If the influence of the rotor acceleration is not taken into account the following problem algorithm considering the rotor speed changes can be suggested:

- The transient process is divided into small uniform intervals of time ;
- The speed increment over the given interval is determined by solving the equation (17) as follows :

$$\Delta s = \frac{T - T_{\text{mech}}}{M} \Delta t ;$$

- The sustained component of the I_{s0} current is calculated at the constant speed obtained for the given time interval ;
- The amplitude of the I_{s1} current component decaying with the time constant τ_a is calculated at the initial value of the rotor speed (at the beginning of the first interval) ;
- The natural angular frequency, ω_n , and the time constant, τ_a , of the aperiodic current component are re-counted using equation (7),(8) in relation to the slip changes of a rotor ;
- The amplitude of the I_{s2} current component caused by the transient currents in the rotor circuits is determined at the rotor slip corresponding to the first instant of the process.
- It should be pointed out that the angular speed of the I_{s2} current being taken into account in (10) varies with the slip changes. The rotor slip dependence of the natural angular frequency and the time constant of decaying the magnetic flux ψ_{s1} are taken into account by equation (16).

ESTIMATION OF MODEL VALIDITY

The efficiency of application of the frequency-response characteristics for calculating the transient process can be demonstrated with the following examples:

1. Short-circuit at the terminals of the stator winding and connection to the network without excitation of the model turbo generator of the MT-3 type:

$$(S_n = 30\text{KVA}, V_n = 414\text{V}, I_n = 41.8\text{A}, \\ x_d = 1.453; x_q = 1.394; R_{s0} = 0.00624\text{p.u.})$$

In the case being considered the influence of the sign and initial slip value at connecting the generator to the network as well as the influence of the rotor speed changes at the transient conditions were analyzed.

2. Connection to the network of the unexcited turbo generator of the TГB-200 type:

$$S_n = 235\text{MVA}, V_n = 15.75\text{KV}, I_n = 8635\text{A}, \\ x_d = 1.9; x_q = 1.89; R_{s0} = 0.0012\text{p.u.}$$

When calculating the electromechanical transients the errors being brought about by simplifying the complicated equivalent circuits, reflecting the electromagnetic of the solid rotor, were considered.

3. Starting of the induction motor of the ДА30-1914-10/12A type:

$P_n = 1500\text{Kw}; I_n = 204\text{A}; V_n = 6000\text{V}$ from the no-load condition, and three-phase short-circuit at its terminals.

Estimation of the results obtained, when using the techniques proposed above, was carried out by comparison with the appropriate calculations made by the use of algorithms based on numerical integrating the system of the differential Parc-Gorev equations. The frequency-response characteristics reflecting the dynamic properties of the AC machines being studied were obtained experimentally from the DC decay in the armature winding at standstill test [8, 7, 17].

Computer programs realizing the above mentioned algorithms for calculating the electromechanical transients in AC machines were elaborated within the framework of the MathCAD 7.0.

The time-dependence of changing the generalized stator current vector and the electromagnetic running torque at connection

the unexcited model generator to the network under the various initial rotor slips were carried out without the account and in view of changing the rotor speed at transient. The invariable rotor speed was simulated by way of setting the great value of the inertia constant [9]. As follows from comparison of the results obtained for the given slip values, equal to 0; 0.01; 0.03; 0.05 and 0.1 put., the changes in the time-dependence of the generalized stator current vector and electromagnetic torque practically does not differ from the analogous calculations made on the basis of the Parc-Gorev equations. In these cases the difference in the maximum values of the similar operating variables being compared did not exceed 10.4%. The typical changes in the transients differ not at all. So, when making use of the static frequency-response characteristics, one can infer that the electromagnetic processes may be identified with a sufficiently high degree of accuracy. The analysis of the transients calculated with taking into consideration the rotor speed changes, following the connection of the model generator, points to some differences in the time-dependent variables. By way of example, in the Figure 2 are shown the results of calculating the transients at connection the unexcited model machine to the network with the field winding short-circuited. The calculations carried out in compliance with the system of Parc-Gorev equations (see dotted line) reflect the features connected with changes in the current, I_s , and electromagnetic torque, T , with the rotor speed changes. The time dependence of the slip in the case under consideration has the oscillatory character. Mathematical simulation based on the static characteristics (see solid line) brings about the monotonous changes in the rotor slip under the transient process. Meanwhile, the resultant time of approaching the rotor speed to the synchronous one, being estimated at the instant a rotor slip for the second time passes through zero, practically agrees with the time being determined from the solid line obtained at simulating the transients by means of the method proposed. As may be seen from the Figure 2. Distinguishing features of the variables being considered are in close agreement; their maximum values appearing at the initial stage of the transient process correlate well with the data

got without regard for speed changes of the rotor. In the Figure 3 are given the curves reflecting the changes in the variables at the short-circuit on the terminals of the induction motor ДАЗО-1914-10/12А type.

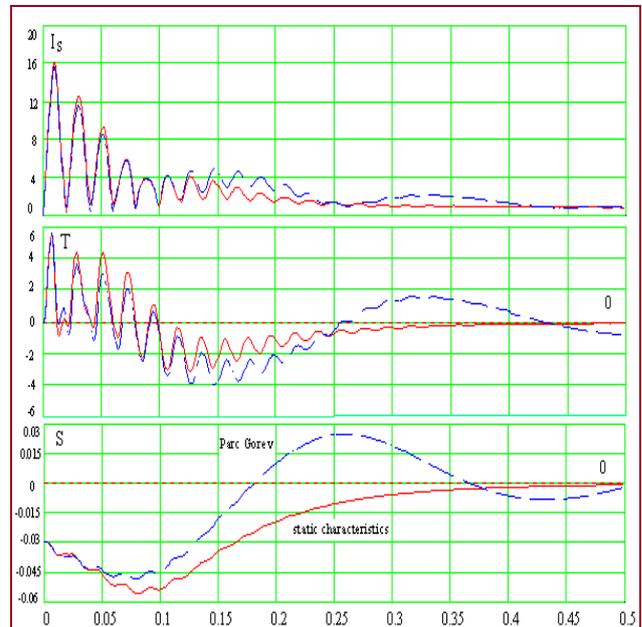


Figure 2 Connection to the network of the unexcited model turbo generator

The quantities of the motor equivalent circuits synthesized in accordance with [4,10] having three parallel branches and the magnetizing one, separated in the manner as is shown in the Figure 1, are as follows (in per unit on machine base):

$$X_{\delta} + X_{\gamma} = 2.19; X_1 = 0.271; X_2 = 1.179$$

$$X_3 = 0.717; R_1 = 0.0055; R_2 = 0.1139$$

$$R_3 = 0.624$$

The comparative analysis of the results obtained by calculating the generalized stator current vector, I_s and electromagnetic torque, T , calculated by various methods points to their close agreement because of the maximum values of the mentioned variables differ less than 7,8%.

The analysis of the electromechanical transients at starting the non-loaded motor also indicates to the satisfactory coinciding of the results obtained by using the mentioned calculation techniques. In particular, the starting time determined by the technique proposed differs from the same parameter obtained through the use of the Parc Gorev equations less than 9, 2%.

As is seen from the Figure 4, the electromagnetic transients within the time interval from 0 up to 0,1 s

correspond closely with the results obtained by the Parc Gorev equation (see dotted line).

The mentioned acceptable results are attributable to the fact that the change in the motor speed takes place at the small rotor acceleration. In this case, the application of the frequency-response characteristics of a machine does not introduce large errors into calculation of the transient processes. When the rotor speed is close to the rated value there are considerable deviations in the changes of the current and electromagnetic torque with time.

As may be inferred from the research, the mentioned deviations decrease with increasing the inertia constant, M , and the loading factor of the induction motor. The transients in this case are accompanied by the less acceleration of a rotor.

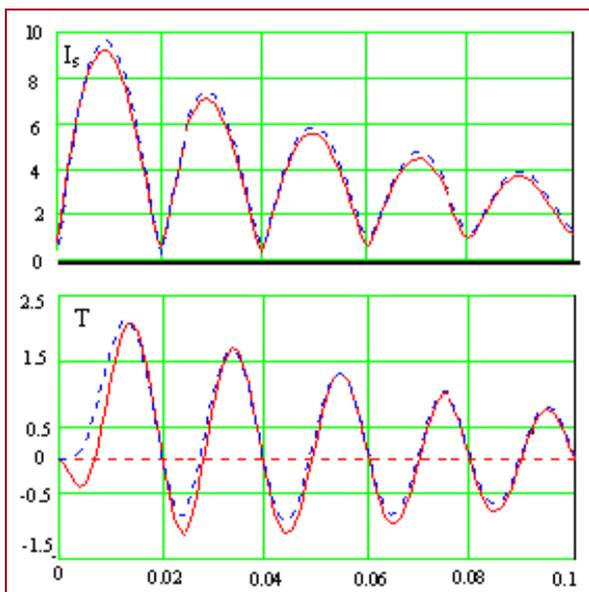


Figure 3 Short-circuit on the terminals of the induction motor.

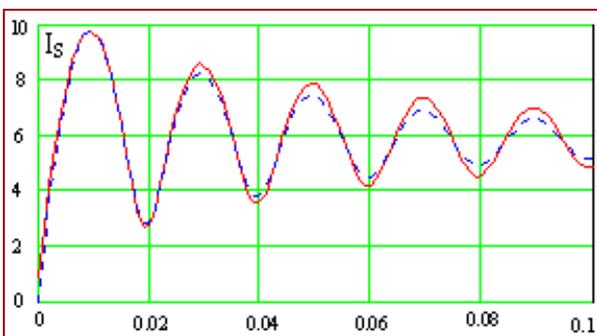


Figure 4 The time –dependence of the generalized vector of the stator current at connecting the induction motor

The investigation of the transients called forth by connection of the unexcited turbo generator TTB-200 type to the network was carried out with the use of the equivalent circuits containing five parallel branches in d - and q -axis [6]. It was ascertained that the errors being introduced in the transient processes by reducing the quantity of the circuit branches, describing the physical properties of the solid rotor, to three do not exceed the errors in a frequency domain equal to 11%.

CONCLUSIONS

The proposed mathematical models of the asynchronous machines based on the experimental frequency-response characteristics allow to investigate the transients processes at short-circuits and connection of the machines to the network without solution of the conventional differential equations.

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COMPARISON OF CUTTING TOOLS INSERTS MADE OF COATED CARBIDE USED IN TURNING OF GREY CAST IRON

■ **Abstract:**

This article presents comparisons of coated carbide cutting tool inserts used in machining of cylinder liners made of grey cast iron. The comparison has been realized through the tool life tests. The measurement has been carried out at three cutting speeds at constant cutting conditions. From the obtained values, the regression coefficients have been evaluated. Subsequently, extrapolation has been carried out by means of the regression line for the cutting speed in the range of 250 – 500 m/min, and for this the extended cutting speed range the interval reliability has been evaluated.

■ **Keywords:**

metal machining, coated carbides, cutting tool inserts, tool life tests, Taylor's equation

■ **INTRODUCTION**

Carbides are the most prevalent tool materials, they are tough and they can be used for machining using high feed rate speed, and for difficult intermittent machining.

Coated carbides consist of a hard carbide base and coating, which increases the thermochemical stability (carbides, nitrides, oxides and their combinations). As a result we get high-quality materials for a high rate of material removal and intermittent machining.

The basic carbides for production of common types of carbides for machining are tungsten carbide (WC) and titanium carbide (TiC), the bonding metal is cobalt (Co). As the other compounds the following are the most used: tantalum carbide (TaC), niobium carbide (NiC) and chromium carbide (Cr₃C₂). Uncoated carbides are divided into three groups: K-grade, P-grade and M-grade. According to the ISO standards, K-grade is a category that includes carbide cutting tools best suited for machining

cast irons and nonferrous metals and alloys; M-grade is a category that includes carbide cutting tools best suited for machining ductile irons, harder steels, stainless steels, and high-temperature alloys; P-grade is a category that includes carbide cutting tools best suited for machining a variety of steels. Coated carbides are produced in the following way: the base made from common carbide (K-grade, M-grade, or P-grade) is coated with a material with high hardness and excellent abrasion resistance.

In the laboratories of the Department of Machining and Assembly, Faculty of Mechanical Engineering, Technical University of Liberec, within various diploma thesis two types of the coated carbide inserts (CCI) have been compared. Both CCIs, type CNMA 12 04 08 AC 300G and CNMA 12 04 08 AC 700G (thereinafter AC 300G, AC 700G), were manufactured by the Sumitomo Electric Company. Through the long-time tool life tests the flank wear of the CCI have been evaluated.

■ **LONG-TIME TOOL LIFE TESTS**
 ■ **TOOL LIFE DETERMINATION**

The life of the cutting tool is expressed by the time of work of the cutting tool from its sharpening to its blunting. The tool life, T , is given as the time, at which the flank wear criterion VB_{Crit} is reached. To obtain the values of the flank wear criterion the method of the linear interpolation was used. The interpolation was counted from the nearest higher and the nearest lower wear value. The final tool life, T , at a given cutting speed v_c , is expressed as:

$$T = t_A + \left[\frac{t_B - t_A}{VB_B - VB_A} \cdot (VB_{krit} - VB_A) \right] [\text{min}] \quad (1)$$

where:

t_A – time, at which the nearest lower value than VB_{Crit} of the flank wear VB_A [min] was reached,

t_B – time, at which the nearest higher value than VB_{Crit} of the flank wear VB_B [min] was reached.

■ **EVALUATION OF THE EXPONENT “M” IN THE TAYLOR’S EQUATION**

An important criterion for comparison of the CCI is the exponent m in the Taylor’s equation. It expresses the influence of the cutting speed on the cutting edge life. The higher the value of the m exponent, the more sensitive the CCI to the cutting speed change. The value of this exponent is usually listed in the catalogues provided by the manufacturers of the CCI, and it is in a range of $m = 1$ to 12 .

To determine the values of the regression coefficients a , b in the linear regression equation it is possible to use the least square method. Subsequently, the standard deviations s_a , s_b are evaluated, as well as the intervals of reliability $L_{(a)1,2}$, $L_{(b)1,2}$ for both regression coefficients. The equations used for a , b , s_a , s_b , $L_{(a)1,2}$, $L_{(b)1,2}$ evaluation are given in [9].

The interval of reliability $L_{1,2}$ for a range of the cutting speeds is then determined from (2).

$$L_{1,2} = Y_i \pm t_{\alpha} \cdot s_{y,x} \cdot \sqrt{\frac{1}{n} + \frac{(x_i - \bar{x})^2}{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}} \quad (2)$$

where:

Y_i values counted from the regression equation for corresponding x_i values

t_{α} critical value of the Student’s distribution

$s_{y,x}$ standard deviation, which characterizes the dispersion around the regression line

n number of values

x_i value of the logarithm of the cutting speed

\bar{x} average value of the independent variable x

To evaluate the m exponent and the constants C_v , C_t in the Taylor’s equation, the regression coefficients a , b are used according to the relations (3), (4), (5). Equations (3), (4) and (5), were according to sources [9].

$$m = -b \quad (3)$$

$$C_T = 10^a \quad (4)$$

$$C_V = C_T^{\frac{1}{m}} \quad (5)$$

■ **EXPERIMENT PREPARATION**

■ **BASIC CHARACTERISTICS OF THE CARBIDES UNDER TEST**

As mentioned above, for the life test we have used CCI manufactured by the Sumitomo Electric Company: AC 300G, AC 700G. These CCI are modern materials for machining the grey cast iron and ductile cast iron. The AC 300G CCI is suitable for continuous machining and the AC 700G CCI is suitable for rough turning and intermittent machining.

Among the main benefits of the AC 300G and AC 700G CCI belongs the newly invented superfilm $\alpha\text{-Al}_2\text{O}_3$, which increases the thermal resistance by up to 30% in comparison with the commonly used Al_2O_3 . These CCI exhibit up to 150% higher resistance to abrasive flank wear. In comparison with other materials, these CCI have, at the same machining conditions, considerably higher durability and they are ideal for dry machining.

■ **MATERIAL, MACHINERY AND EQUIPMENT**

The tool life tests were performed on the cylinder liners made from grey cast iron alloy, ČSN 42 24 25, that were produced by the AGS Jičín Company (see Figure 1).

The material was machined by a turning machine SU 50, from the point A to the point B. The material was gripped in the machine by its inner diameter, in the 3-jaw chuck on one side of the cylinder, and in a supporting device clamped in a tailstock pin on the other side. The tool wear was evaluated on its clearance face out of the machine, with the aid of the microscope CARL - ZEISS JENA with an accuracy

of 0.01 mm. We used a digital revolution meter ONO SOKKI HT – 3100, with the measuring pin positioned in the spindle centreline, to measure the revolutions.

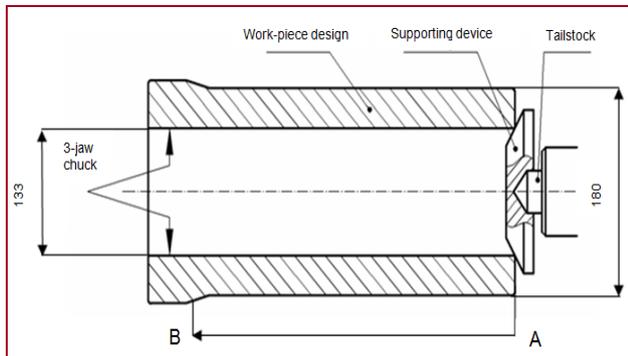


Fig. 1 Cylinder liner [5]

Both types of the CCI had a rhombic profile and the same geometry of the cutting edge (clearance angle $\alpha_0 = 5^\circ$, cutting edge angle $\beta_0 = 90^\circ$, rake angle $\gamma_0 = -5^\circ$, back rake angle $\lambda_0 = -5^\circ$, end cutting edge angle $\chi_r = 95^\circ$). We used a tool holder, PCLNR 25 25 M12 T, for fastening the CCI.

CHOSEN CUTTING CONDITIONS

Among the recommended machining parameters for the AC 300G CCI are the cutting speed of $v_c = 100$ to 350 m/min and the feed rate of $f = 0.1$ to 0.6 mm/rev. For the AC 700G CCI the recommended cutting speed is of $v_c = 100$ to 350 m/min and the feed rate of $f = 0.1$ to 0.8 mm/rev [7]. With respect to these parameters, the cutting conditions were established.

The main influence on the cutting tool life exhibit the cutting speed, depth of cut, and the feed rate speed. For both CCIs (AC 300G, AC 700G) were chosen three series of the theoretical cutting speeds: $v_{c1} \approx 280$ m/min, $v_{c2} \approx 350$ m/min, $v_{c3} \approx 460$ m/min. In Table 1, the cutting conditions are shown for individual CCIs.

Tab. 1 Cutting conditions of compared CCI

CCI	f [mm/rev]	a_p [mm]
AC 300G	0.1	2
AC 700G	0.3	2

We used so called dry machining. The benefits of dry machining are: decreasing the investments in cutting fluids, environment and health protection and higher machining productivity. When using this method of machining, the

temperature is higher and also more stable. That often means better chip formation, and therefore the power needed is decreased.

CCI EVALUATION
AC 300G CCI

To specify the relation $VB = f(t)$, it was necessary to determine the average machining cutting speed. As the SU 50 turning machine does not have a smooth range of revolutions, it was not easy for the long-time tool life tests to secure a constant cutting speed. The counted average cutting speeds are shown in Table 2.

Tab. 2 Average values of cutting speeds v_c for the experimental AC 300G cutting insert

AC 300G CCI		
v_{c1} [m/min]	v_{c2} [m/min]	v_{c3} [m/min]
285.5	348.3	434.5

Within the solution it was necessary to choose the value of the flank wear criterion VB_{crit} , while demanding the maximal use of the area of the stabilized machining at the same time. In consequence of the remarkably different courses of wear for each tested CCI, it was necessary to choose a different VB_{crit} value for each of them. The relation $VB = f(t)$ was crucial for establishing the value of the flank wear criterion VB_{crit} . Based on this relation, the value of the flank wear criterion VB_{crit} was set to $VB_{crit} = 0.20$ mm for AC 300G. The dependence of the wear on time $VB = f(t)$ is shown in Figure 2.

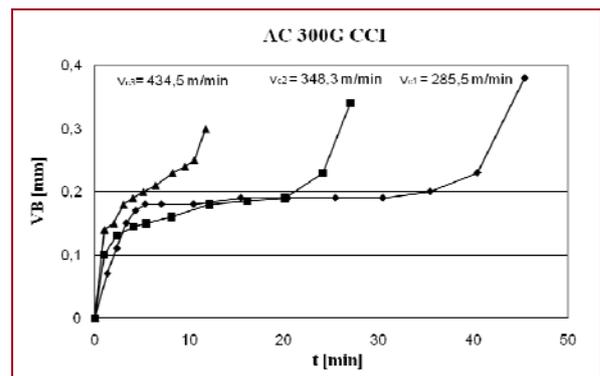


Fig. 2 Graphic dependence of $VB=f(t)$ for the experimental AC 300G cutting insert

The cutting edge durability was for individual average cutting speeds determined by the method of linear interpolation, using the relation (1). The durability counted for all cutting edges AC 300G is listed in Table 3.

Tab. 3 Values of calculated tool life for the experimental AC 300G cutting insert

v_c [m/min]	VB_{Crit} [mm]	t_A [min]	t_B [min]	VB_A [mm]	VB_B [mm]	T [min]
285.5	0.20	30.4	40.4	0.19	0.23	32.9
348.3		20.1	24.1	0.19	0.23	21.1
434.5		4.0	6.4	0.19	0.21	5.2

The measurement was performed at three cutting speeds. Subsequently, extrapolation was carried out with the aid of the regression line for values in a range of 250 – 500 m/min and the interval reliability was determined for this extended cutting speed band, see Table 4. Student's distribution was used for the calculation, for the significance level of $t_\alpha = 3.078$, $\alpha = 90\%$, $f = 1$ [4,5].

Tab. 4 Corresponding intervals of reliability for the experimental AC 300G cutting insert

v_c [m/min]	L_1 (-)	L_2 (+)	T [min]
250.0	17.4	272.7	68.8
285.5	14.5	101.2	32.9
300.0	13.2	71.3	30.7
348.3	8.5	29.6	21.1
400.0	3.9	18.8	8.6
434.5	2.2	16.1	5.2
500.0	0.8	13.3	3.2

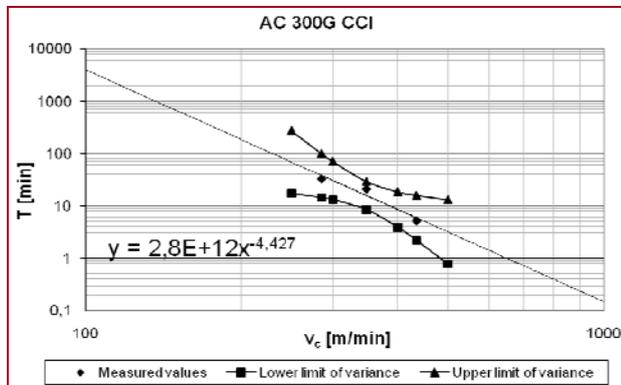


Fig. 3 Experimental relationship between tool life data and different cutting speeds for the experimental AC 300G cutting insert

In Figure 3 you can see the dependency of the durability on the cutting speed $T = f(v_c)$ together with the confidence band for the linear regression dependence.

AC 700G CCI

When evaluating the experiment performed with AG 700G CCI we were following the same steps as for the AC 300G CCI. The counted

average cutting speeds for three sets of the cutting speeds are shown in Table 5.

Tab. 5 Average values of cutting speeds v_c for the experimental AC 700G cutting insert

AC 700G;		
v_{c1} [m/min]	v_{c2} [m/min]	v_{c3} [m/min]
283.0	353.9/345.0	445.7

Based on the relation $VB = f(t)$, the value of the flank wear criterion VB_{Crit} was set to $VB_{Crit} = 0.30$ mm for AC 700G. The dependence of the wear on time $VB = f(t)$ is shown in Figure 4.

When machining the AC 700G CCI, at the speed of $v_{c2} = 353.92$ m/min and time $t = 17.2$ min from the test start, the cutting edge broke at the peak of the CCI. Then it was experimented with average cutting speed $v_{c2} = 345.0$ m/min.

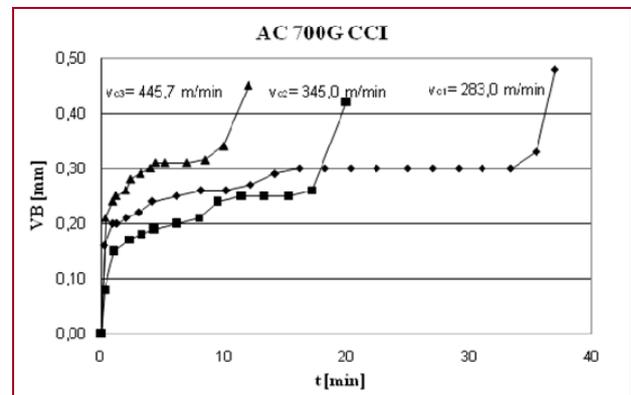


Fig. 4 Graphic dependence of $VB=f(t)$ for the experimental AC 700G cutting insert

Tab. 6 Values of calculated tool life for the experimental AC 700G cutting insert

v_c [m/min]	VB_{Crit} [mm]	t_A [min]	t_B [min]	VB_A [mm]	VB_B [mm]	T [min]
283.00	0.30	14.20	35.50	0.29	0.33	19.50
345.00		10.50	20.10	0.28	0.32	15.30
445.70		3.25	7.00	0.29	0.31	5.10

The durability counted for the CCI with the AC 700G is listed in Table 6. To compare the CCIs we chose the value of the flank wear criterion $VB_{Crit} = 0.30$ mm for the AC 700G. The interval reliability for the extended cutting speed band for the AC 700G is shown in Table 7.

Tab. 7 Corresponding intervals of reliability for the experimental AC 700G cutting insert

v_c [m/min]	L_1 (-)	L_2 (+)	T [min]
250.0	11.4	90.8	32.2
283.0	10.3	47.5	19.5
300.0	9.7	35.7	18.6
345.0	7.4	20.1	15.3
400.0	4.3	14.3	7.8
445.7	2.5	12.6	5.1
500.0	1.4	11.5	4.0

In Figure 5 you can see the dependency of the durability on the cutting speed $T = f(v_c)$ together with the confidence band for the linear regression dependence.

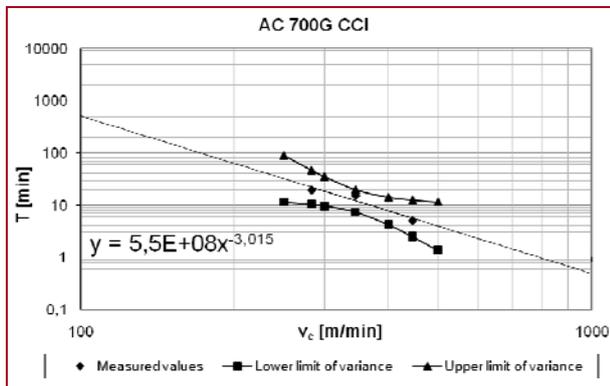


Fig. 5 Experimental relationship between tool life data and different cutting speeds for the experimental AC 700G cutting insert

■ COUNTED VALUES OF CCI

Concrete counted values of the regression coefficients a , b , standard deviations s_a , s_b , exponent m and the constants C_T , C_V in the Taylor's equation are listed in Table 8.

Tab. 8 Tabulated summary of resulting values

CCI	a	b	s_a	s_b	m	C_T	C_V
AC 300G	12.45	- 4.42	3.00	1.18	4.43	2.84E +12	650.45
AC 700G	8.73	- 3.01	2.20	0.87	3.02	5.49E +08	791.06

■ ANALYSIS AND CONCLUSION

We have performed long-time life tests for coated carbide inserts (CCI) of a type CNMA 12 04 08 AC 300G (AC 300G), CNMA 12 04 08 AC 700G (AC 700G), which were manufactured by the Sumitomo Electric Company. The measurement was performed with cylinder liners made from grey cast iron alloy ČSN 42 24 25. Their evaluation was carried out within linear regression.

The crucial influence on the tool life has the cutting speed. Therefore, the tool life of the CCI was assessed at three cutting speeds. To gain an extended cutting speed band, we obtained tool life values from the regression relations. We chose the cutting speed band for both CCIs of 250 – 500 m/min.

For each CCI we selected different values of the $V_{B_{crit}}$ when performing the experiment. The reasons were extremely different courses of

wear for each tested CCI, and the use of the area of stable machining.

The highest evaluated tool life for the AC 300G CCI was $T = 68.8$ min for the cutting speed of $v_c = 250$ m/min, and the lowest tool life value was $T = 3.2$ min for the cutting speed of $v_c = 500$ m/min. The AC 300G CCI is intended for the cutting speed up to 350 m/min; this value corresponds with the manufacturer's data. For the speed of $v_c > 500$ m/min it is not possible to recommend this CCI, due to the low tool life value. Under these measurement conditions it is not possible to recommend the AC 300G CCI for high-speed machining.

For the lower value of the cutting speed $v_c = 250$ m/min, the tool life of the AC 700G CCI was counted as $T = 32.2$ min. In comparison with the AC 300G CCI, the tool life is, at the given conditions, lower by 36.6 min. For the upper value of the cutting speed $v_c = 500$ m/min, the tool life was counted as $T = 4.0$ min.

The AC 700G CCI is, as well as the AC 300G, intended for the cutting speed up to 350 m/min max. Under the conditions we used for our experiments we cannot recommend the AC 700G CCI for high-speed machining.

From the comparison of the two types of CCI made from carbides it seems that, in terms of the tool life attained within given conditions, the better CCI is the one identified as AC 300G.

For machining the grey cast iron continuously it seems to be preferable to use the cutting tool inserts (CTI) made from cutting ceramics. During experiments, it has been proved that these CTIs have, at the same cutting conditions, higher tool life [8]. When machining intermittently it seems to be preferable to use the cutting tool inserts made from carbides.

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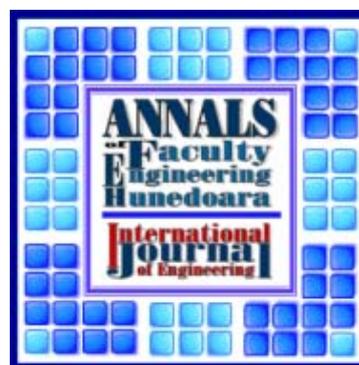
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COMPUTER TRAINING IN CHEMISTRY: STRENGTHS AND WEAKNESSES

■ **Abstract:**

Chemistry, as a subject of study, can not be taken into consideration without the computer science, especially nowadays. The issue of using computer in education has been deeply and multilateral researched in many countries, and the proposed solutions were determined, on the one hand, by the stage of education within that country, and, on the other hand, by the computerization degree of the society. Within the information society, the use of information and communication technologies in the educational system becomes a necessity. Interest in studying Chemical elements with the help of computer is determined by a number of cases to be presented in this paper.

■ **Keywords:**

chemistry, computer assisted learning, method of training, educational software, computer and software integration in school, AeL software platform, SIVECO Romania

■ **TEORETICAL CONSIDERATIONS**

Computer assisted learning, as a method of training, has a major function in increasing the effectiveness of educational training process. Computer assisted training as a method of learning-assessment certainly contributes to changing the educational curriculum. It was established that the computer and its facilities are still little explored within the educational system in Romania. The computer, in this case, is used as a means of education which runs educational programs and thus assists the teacher in the act of teaching, formative and summative assessment and the student in learning and assessment process. It is obvious that technology continues to develop rapidly suggesting new possibilities to all sectors hence education also.

Attraction for educational software consists in competitiveness, dynamic design, user initiative, program documentation and flexibility to adapt. Computer and software integration in school

and thus in the educational process is a necessity dictated by current requirements. The accomplishment of educational programs is not an aim in itself. They are edited to be applied in teaching activities conducted by educators and educated.

The information era consists of three periods: the information society, knowledge society and awareness society. Increased IT knowledge among teachers and students is an important step towards the information society.

Currently, the AeL software platform developed by SIVECO Romania is being used; it is based on a learning situation that reevaluates the opportunity to present educational materials as new, dynamic, interactive methods, induced by computer use and it presents a number of benefits directed to the favorable attitude of the student to study.

New information technologies should be considered as a means of teaching (integrated in teaching various subjects, including Chemistry)

with important role in improving the quality of teaching and improving the educational process.

Patterns to use Computer Assisted Training in the education process were traditionally the same: setting and controlling knowledge, modeling and visualization of processes and phenomena in explaining the new materials, texts processing, development of logical thinking, individual shaping of processes by students.

It was established that the number and intensity of research on Computer Assisted Instruction in various countries is directly proportional to the degree of computerization of the educational process and the readiness of teachers to apply the computer in teaching Chemistry. Despite research that addresses a deeper or more superficial extent, the problem of computer use in studying chemistry, remains a less explored area.

Chemistry, and other related disciplines (Physics, Mathematics, Biology) has also benefited from the e-Learning applications, the new perspectives that the computer and the Internet bring in the training process. Learning Chemistry through another method, Computer Assisted Training, is a challenge and a "something else" in the same time, and combining them with other methods of teaching-learning is a necessity.

Computer assisted learning involves two important aspects:

- ✚ Developing a training program, which is the result of educational programming, thus an educational product;
- ✚ Transcription of this program in the computer program, which is an informatics product.

Teachers who want to use the project method in class are forced to adopt new educational strategies to get results. Direct education methods that rely on manuals, presentations and traditional assessments do not work too well in an open learning process, interdisciplinary, that describes the project-based learning.

Most teachers are not prepared to assume themselves the role of guide or facilitator and to teach this way. Those who make the transition to project-based instruction are facing some challenges to be overcome by the use of new teaching methods. As teachers and students

work together on projects and integrate technologies, their roles change, and the educational space rearranges its performers.

The projects require a change in the role of teacher. Teachers who are familiar with the exposures and rely on existing textbooks or materials may have difficulties in switching to a learner-centered approach. This means to waive the unidirectional control allowing students to work in multiple directions, in different activities in the same time. While the planning phase of the project requires more time to prepare, once the project is started, the teacher acts as a coach or facilitator. For teachers, this is interesting and it is a method to approach to individual styles and creativity of students.

■ EDUCATIONAL SOFTWARE IN CHEMISTRY

Educational software is the name of a program designed in relation to a series of teaching coordinates (behavioral objectives, specific content) and technical coordinates (providing individualized interaction, the feedback sequence and formative assessment); broadly an educational software is any program designed for use in training and learning.

Educational software in Chemistry is intended for students, or any person interested in this area. This software is designed to attract users by allowing them to conduct chemical experiments lacking the specific materials. With 3D models learners can see how chemicals look like, how certain reactions take place and may view certain phenomena which can not be visible virtually.

The various examples presented by SIVECO refer to studying periodic system of elements, isotopes and nuclear reactions, the reactions equations stoichiometry and analytical methods of quantitative and qualitative ions in solutions. By using the simulation models the time needed to assimilate concepts and specific concepts of analysis is to be shortened and operating costs of each method are to be minimal. Furthermore, the large number of possibilities and parameters of the software used can give their users the flexibility needed to acquire a correct analysis on samples with unknown compositions and concentrations. Without replacing the direct contact with chemical substances and equipment, the works on computer enrich the possibilities of acquiring knowledge and actively

implementing them. By using computer the learning potential is huge. The computer provides students and teachers "the opening" to the world, to the others. He gives the student the way to overcome isolation. For teacher and student altogether, the computer represents a great help during classes and elsewhere.

Weaknesses for computer use:

- ✚ it affects the child's posture;
- ✚ it enlarges diopters;
- ✚ it determines aggressive behavior due to games;
- ✚ it allows the child to relate to unknown persons.

Strengths for computer use:

- ✚ the child learns to control an instrument by playing;
- ✚ it improves hand eye coordination;
- ✚ it speeds up the reaction;
- ✚ it offers the opportunity to explore the world and create original work;
- ✚ it facilitates the interpersonal relationships;
- ✚ the child gets a good opinion of himself;
- ✚ it improves his school performances.

To students, the computer has only strengths.

The interactive software has a strategy that allows feedback and ongoing monitoring, resulting in an individualization of course depending on the subject's knowledge.

Following the analysis we did to achieve this work, we can say that the main features of computer assisted instruction are:

- ✚ ensure unity among the functions of communication, storage and control, resulting in improved learning by feedback effect;
- ✚ exempt professor from teaching a series of acts of routine (teaching, repetition, evaluation, etc.), thus giving him the opportunity to focus his efforts and time to refine studied material (by steps and investigation);
- ✚ require combining the study by reading the manual or the computer with other bibliographic materials and experiment
- ✚ require maintaining the relationship "teacher-student" working in groups or with the whole class to confront the results, to create that climate, develop a sense of community;
- ✚ provide an active reception of knowledge, depending on students working at their own pace;

- ✚ teach students self-control and management of their intellectual activities

- ✚ create the possibility to revise the poorly understood problems and thus to make a conscious approach to knowledge.

The educational software designed for simulations and virtual experiments to teach chemistry lessons has the following advantages:

- ✚ allows teachers and students to create fast, easy and secure virtual experiments needed to understand certain phenomena;
- ✚ there are no actually consumed substances, no broken utensils, no materials, which are usually very expensive;
- ✚ there is no toxic working environment as in a chemistry laboratory;
- ✚ accidents are eliminated when conducting highly dangerous experiments;
- ✚ virtual experiments can be achieved in a much shorter time, thus saving time;
- ✚ virtual experiment to determine the chemical nature of a solution can successfully replace the real experiment when it does not exist in the laboratory.

The use of AeL platform and its own programs lead to a teaching-learning process more efficient and attractive to students and teachers.

The use of computer in teaching Chemistry has both advantages and disadvantages:

■ ADVANTAGES

- ✚ the use of computer provides a high degree of individualization and independence of learning, ensuring the reverse learning link
- ✚ through feedback, the amount of acquired knowledge is being increased
- ✚ computer assisted learning provides a self-paced learning
- ✚ it ensures a conscious knowledge acquirement
- ✚ it sequences the scientific content
- ✚ it facilitates the ongoing evaluation of results

■ DISADVANTAGES

- ✚ the poor endowment with computers leads to the fact that students can not work simultaneously, moreover, not all students have the same skill in computer use
- ✚ a depersonalization of teaching-learning act
- ✚ excessive individualization of learning can lead to denial of student-teacher dialogue

- ✚ due to content sequencing, the students may not have the representation of the phenomenon
- ✚ when using the directed learning, the student may not express his spirit of independence and creativity

CONCLUSIONS

We like to believe that the time we used the laboratory only for experiments has gone, that there is no longer that exasperation of students forced to do well with little. But this is not completely true.

In most schools in the country the activity takes place in chemistry laboratories, in case that they exist or are still functional. This is where the virtual education with its computers and programs comes into discussion. An instauration of educational system has taken place.

When designing software to perform a range of experiments, there should be as many parameters as possible to study physical phenomena. Thus the teacher can approach different work strategies in the class according to the performances he wants to achieve.

The real laboratory should not be removed from the process of training. The twotypes of experiments should complement each other. By using computer applications, an ideal working space is being created and human errors inherent in real experiments are being eliminated.

The main reasons for which we consider interactive virtual experiment useful, would be related to the assessment of rigorous scientific content by the students and to the development of investigative capacity, creativity, modeling, analysis, interpretation, generalization, and confirmation of studied phenomena.

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OPTIMIZATION OF ENTERPRISE PROCESSES BY MEANS OF IMPLEMENTATION OF AN EFFICIENT ERP SYSTEM

■ **Abstract:**

Optimal functioning of an enterprise in the present era of knowledge economy is related with the demand of efficiency increase in organizing, planning, control and outputs of flows beginning with development and purchase and ending by manufacturing and distribution according to needs of customers so that all conditions of market by minimal costs and capital expenses, while maximizing income of the enterprise. These facts lead to the demand for a qualitative and efficient information system of the enterprise, which is at present becoming the key factor of success on the market. The enterprises that do not put their attention to inclusion of modern information technologies are getting themselves into strategic disadvantage compared to their competition.

■ **Keywords:**

ERP system, optimization of enterprise processes, implementation, efficiency

■ **INTRODUCTION**

The present economics is mainly characterized by globalization and accelerating dynamics of market and production cycles. The terms of deliveries are getting shorter, competition is increasing, the complexity of services is getting broader and control of relations with customers is changing. The enterprises that do not continuously focus on implementation of modern information technologies are getting into competitive disadvantage and they can easily find themselves in crisis. The importance of information systems that are becoming a key factor of success is therefore increasing.

The presented article deals with clarification of foundations of information systems, evaluation of demands on an efficient ERP system, the process of design and approach of creation of an efficient information system will also be clarified. The article also contains analysis of incorporation of a chosen information system in a chosen enterprise, together with its situation

before implementation of ERP system through the course of implementation of the system to evaluation of its advantages.

■ **THE FOUNDATIONS OF ERP SYSTEMS**

Enterprise Resource Planning (ERP) is designation for a software system that is set to support and automate processes in an organization. It is usually a broad package that covers areas of production, distribution, human resources management, project control, salaries and accounting. Companies usually do not use all the modules, just the part they need. ERPS promises to integrate all sections and operations of a company into a unified software package. In the last years, the definition of ERP is getting broader with new terms and areas. Modules like Customer Relationship Management or Supply Chain Management or business intelligence are becoming parts of ERP systems. (Khouri et al. 2009a)

■ **DEMANDS ON EFFICIENT ERP SYSTEM OF AN ENTERPRISE**

Information systems have to fulfill certain basic demands reflecting their quality. These ones belong among them:

- ✚ information have to be representative of substance and needs on individual levels of control,
- ✚ frequency and speed of data obtaining have to allow their efficient use by decision making,
- ✚ channels of delivery have to be modified towards the organizational structure taking in account the need of shortest path between sender and receiver,
- ✚ by delivery of data it is necessary to avoid middle elements, which deform and disturb information,
- ✚ forms of data presentation have to be communicative and flexible to possibilities of their understanding by their recipients,
- ✚ information system has to fulfill integrative function and integrate mutually or units of the company and secure feedback,
- ✚ information system has to be able to adapt to changing conditions in inner and outer environment of a company.

The basic demands on IS regarding the needs of control of an enterprise can be summarized in the following way:

- ✚ the information system has to supply the needed information inputs into the enterprise and information outputs into surroundings,
- ✚ it has to prepare all inner information needed for control,
 - ❖ it observes the course of controlled processes, obtains, measures and analyses data about the real state of the controlled processes or deviations from the set values,
 - ❖ it prepares the gathered data for processing on the appropriate media,
 - ❖ it secures input of these data for processing and manages its own processing for the needs of control.
- ✚ It has to supply to all organizational units and to every employee all information needed for their activities and this in appropriate form and needed time. The distribution of the processed data has to

secure information inevitable for decision making for the managers. By executive employees, it is giving orders and other information that precisely specify the appointed work and create assumptions for its execution.,

- ✚ It has to fulfill integration role. It has to secure interconnection of all workplaces in the enterprise and to realize the closing of feedbacks without which, control cannot exist..
- ✚ IS has to be flexible, able to develop and adapt to inner and outer conditions and changes in the control system.
- ✚ IS should be efficient, that can be understood as:
 - ❖ Inner efficiency that is demanded by rational organization of the IS, it should be the cheapest (but not at the expense of quality) and
 - ❖ Outer efficiency shown by the effect of the operation of the controlled system that is obtained on the ground of information supplied to the control. (Khouri et al. 2009b)

For any information system to fulfill its task and obtain selected aims, it has to be secured from the following sides:

- ✚ personal – qualified employees
- ✚ technical – information and other technologies,
- ✚ software organizational – means of practical use of the information system.(Al-Zabidi, 2006)

■ **SELECTION OF AN INFORMATION SYSTEM**

The selection of an information system is bound with demands laid upon it. Regarding complexity and functionality of the system, its level is directly proportional to its price. The base of every system applied in manufacturing is complex observation of supplier-customer relations, based on which operations needed for realization of supplies are executed. By using of information system, it is necessary to obtain other functions – be it the system of control and maintenance planning or the actual system of quality and production control (Khouri 2009)

It is important to realize that even if there are different types of information systems, that does not mean that only one of them can be operational in an enterprise. However in

enterprises, usually more types of IS are operated at the same time. Every enterprise has to have a transactional system. For this system many different products exist today, beginning with simple accounting application to complex solutions of the information system (such systems are usually differentiated according to the type of the enterprise and employees count). By selection of an information system it is necessary to take in account:

- ✚ **adequacy of the system** – how much time it takes for a user to obtain the needed information, if the system is user friendly or maintains the needed level of security.,
- ✚ **expandability of the system** – is the adaptively of the system regarding development of the company secured, does the system have recommendations or needed attests. Is it clear that the more unexpected malfunctions will occur the more serious will be results on total incompetence to face such problems. The information should be considered secure only when the mentioned realities are reflected in its design and operation. With ongoing time, the information system becomes a mixture of old and new elements. The ability to cooperate with specialized modules of competitive suppliers of software is also very important and is realized by data bridges,
- ✚ **lot of hardware and database platforms**, on which the system works,
- ✚ **technologic openness** – the author of the information system cooperates with external software companies on development of specific modules.

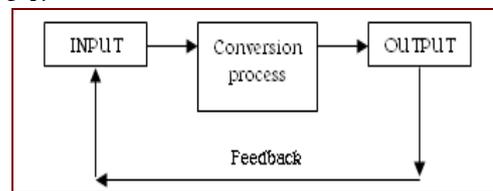
System integrators help the big enterprises that will do the analysis of needs and will set the future – desired state and will completely organize and secure transformation of the information system to the desired state. Advantage of these services lies in decrease of risk of investments into a proprietary software by absence of the needed experience, while transferring the responsibility on the system integrator. The system integrator has to have the knowledge of not very related branches (information technologies, management, logistics, system analysis, quality). (Khoury et al. 2009a)

Before selection of the information system, it is demanded to clear out your business strategy

and aims that the enterprise wants to achieve. The analytics are trying to map official and also informal flows of information. Routine information is found by filling of questionnaires. It is difficult to set the time horizon of a „common” analysis.

■ DESIGN OF AN INFORMATION SYSTEM

By design of an efficient information system, it is inevitable to have information about every important element of the system. In this case the system is the given organization – company. Every system has three basic elements: inputs, conversion process and outputs as shown in the figure 1.



Environment – social, economic, political, technical factors involved in operation of the system

Fig 1. The scheme of an open system

In the process of design of information system it is necessary to take in account that some systems are deterministic, what means that their elements operate in foreseeable or definable relations like clock. Problems in such deterministic system can be easily diagnosed. However, most of systems involving human factor are hard to describe and hard to solve problems in. Such more complex systems are known as stochastic and succumb to high deviations in quantity and quality of their output. All organizations, like all companies are based on human factor and are stochastic in their character.

In an ideal case the model organization system should be self regulative, with embedded methodology of output monitoring with feedback signaling results so any needed modifications could be executed – something like a thermostat that automatically turns on a furnace when temperature gets below desired point. But taking in account the reality that every organization has stochastic nature, design of self regulative system of control represents a very complex task.

To be able to progress further in solution, it is necessary to install sensors into every element of the system: into input, into the conversion

process and also into output. These sensors are part of the data – so called “indicators”, which record the course of operations and allow comparing results to standard output.

The input data have to be gathered continuously, so the demand and resources utilized in services could be observed. Operational algorithms have to be monitored continuously because of obtaining of information about exceptions, errors count and errors in operation of the system. Output information about amount and quality of services is needed to be harmonized with according processes. Except this, there is inevitable need of observation of external environment of organization – data like demographic characteristics of population, which the organization offers it services, services offered by other organization – development of competition, newest changes in ladder of values. These data indicators offer the leading employees a key that can help them in further study of situation and give them means to correct current state. (Khouri et al. 2009a)

The development of a real self regulative information system is not achievable aim. It is however possible to design a system with following qualities:

- ✚ Information system of control has to produce information, not data. It is necessary to process data and analyzes them according to set plans and only then the data can become information usable for leading employees.
- ✚ The gathered data have to be relevant to a purpose of their use. Data have to be sensitive and must supply leading employees with differential and sensible comparisons.
- ✚ Information has to be without bias. It should not be gathered and analyzed only for the purpose of acknowledgment of prophecies of ambitious and egoistic leading employees.
- ✚ The system should be understandable and synoptic. The employees doing decision making should get all important element of the system.
- ✚ Information has to be prepared in time and be to disposal before execution of needed decisions and steps.
- ✚ Information should be oriented on activities and should be in the form of such synthesis, which will make decisions easier, it

shouldn't present only passive facts about present operations.

- ✚ It is important to have data unified and precise; it should give indicators that can be compared in time internally with previous output and externally with experiences and results of other institutions.
- ✚ Data folders should be gathered with regard to aims set before.
- ✚ Expected advantages that can be obtained by using information should be higher than costs needed to get a process it. (Cehlár et al. 2005)

■ IMPLEMENTATION OF AN ERP SYSTEM IN THE SELECTED ENTERPRISE

The function of a complex information system was insufficiently substituted by software from the office package. Except the classics represented by Outlook, Word and Excel software, the enterprise has also created by its own means an application with the form of enterprise portal in FrontPage. The base of the enterprises informational structure were un-interconnected systems of building manufacture control, creation of building budgets, accounting system, salaries and human resources management.

■ Situation in the enterprise before implementation of an ERP system

The function of a complex information system was insufficiently substituted by software from the office package. Except the classics represented by Outlook, Word and Excel software, the enterprise has also created by its own means an application with the form of enterprise portal in FrontPage. The base of the enterprises informational structure were un-interconnected systems of building manufacture control, creation of building budgets, accounting system, salaries and human resources management.

■ Evaluation of needs of the enterprise

There was a tender executed on design and implementation of a complex ERP system for optimization of the most important processes in the enterprise, mainly to improve control of projects and supply of complex services to

customers. The customers (the chosen enterprise) demanded interconnection of information by means of portal on the platform Share Point Portal Server. The new information system should support obtaining of strategic aims of the enterprise, thus obtaining competitive advantage. Implementation of active planning was aimed to improve control of economics and more efficient resources usage. The process of selection was very complicated and it lasted three quarters of a year. The enterprise has had a lot of experience with suppliers and it has considered also in this case many information systems. The main criteria of selection was quality, scalability, know how in the area of control of building manufacture and the most user friendly interface. The other criteria were complexity from the point of view of demands on subsidiary processes and functioning of the enterprise. Support of creation, realization and optimization of projects and support of efficient cooperation with a broad spectrum of external professional partners were also important factors.

■ **The course of implementation of the information system**

After ending of the tender, before beginning of implementation, the enterprise had demanded a workout of integration-implementation study that mapped processes in the enterprise. This study was a important milestone before achieving agreement between enterprise aims of the customer and possibilities of the projected information system. After negotiations and acceptance, the supplier offered a proposal of solution.

The architecture of the system was proposed with the aim to cover all enterprise processes – from search for customers, through bid and preparation of contract, realization of building, handover of the building, to completion of the project. The pillar of solution was the system for support of purchase, sales and finances. The system had to be integrated with the system of control of building manufacture and tools of Cenkos software (the software of creation of building budgets), system for humans resources management and salaries Human and with the enterprise portal offering subsidiary services, as evidence of contacts, management of

attendance, acceptance processes, etc. This conception would eliminate duplicity of data. All specialized demands were worked into the information system of the enterprise. For example, the module Finances demanded deeper economic analyses, more detailed budget planning, building specialties like mortgages, payment calendars, stoppers, workout of projects, observation of costs of individual projects, evaluation of projects, observation of commitments towards certain date, or data acquisition for statistical needs.

Every implementation of changes is facing mistrust at first. It was very important not to loose support from management of the enterprise during the course of the project. Usually the phases of analyzing and testing of outputs of the project are critical. In this process, it is inevitable to cooperate with the customer. In the chose enterprise, it was difficult for the key employees that had to dedicate main part of their work time to cooperation with the implementer of the solution and they had to do their normal responsibilities.

The course of the implementation was monitored on periodic seminars. The customer wanted to be sure, that capacities and financial means will be efficiently used with demanded results, therefore it observed very precisely and consulted the course and fulfillment of tasks. In this way, the project was lead to its final phase.

■ **Evaluation of assets**

After implementation of the information system, the employees obtained a complex entry and quick overview of state of orders and projects. With information share, documents and forms of Share Point Portal Server the duplicities were cancelled and teamwork was simplified.

The solution fulfilled demands of the customer on mobility. The site managers that work on buildings in terrain can connect to the enterprise's portal by use of their notebooks. In this way they solve mainly exchange of information that they need for their operation, like information about course of orders, economics and accounting documents, economics and accounting documents of their projects and similar ones.

By use of online connection they can also report about the actual situation on the particular building that shows a complex overview and

allows a coordinated control of realization of all projects of the enterprise.

The advantage of this ERP system is its ability of horizontal and vertical scaling, so the following system is able to grow with the enterprise. In the future it is possible to implement new functionalities and create new modules.

CONCLUSIONS

A qualitative information system is inevitable in present economics. Time plays ever more important role. Today, not the bigger ones over stronger win, but faster over slower ones win. Managers have to flexibly react on needs of the market and take fast and correct decisions. They need a simple access to actual, precise and complex information, which only a reliable information system based on modern technologies can supply. The qualitative information system is a mean that allows better orientation in market environment and to simplify the process of decision making.

The implementation of an efficient ERP system in the selected enterprise has replaced several incompatible programs and applications. It allowed integration with specific systems for control of building manufacturing and support of the most important enterprise processes – control of projects and supply of complex services to customers from its search up to commitment of the project into operation. It also contributed to more economic use of all disposable resources of the enterprise by lowering workload and removing duplicate activities. Naturally it also offers a complex and fast access to information and overview of state of orders and economic complexes and analysis for the needs of management.

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MHD FREE CONVECTION FLOW PAST AN ACCELERATED VERTICAL POROUS PLATE WITH VARIABLE TEMPERATURE THROUGH A POROUS MEDIUM

■ **Abstract:**

The effect of a uniform transverse magnetic field on the free convection flow of an electrically-conducting fluid past an uniformly accelerated infinite, vertical, porous plate through a porous medium is discussed. The plate temperature is raised linearly with time. Expressions for the velocity field and skin friction are obtained by the Laplace transform technique. The influence of the various parameters, entering into the problem, on the velocity field and skin friction is extensively discussed with the help of graphs.

■ **Keywords:**

Free convection, MHD, porous medium, Accelerated, Vertical porous plate, variable temperature

■ **INTRODUCTION**

Buoyancy forces that arise from density differences in a fluid cause free convection. These density differences are a consequence of temperature gradients within a fluid. Free convection flow is a significant factor in several practical applications that include, for example, cooling of electronic components, in designs related to thermal insulation, material processing, and geothermal systems. Transient natural convection is of fundamental interest in many industrial and environmental situations such as air conditioning systems, human comfort in buildings, atmospheric flows, motors, thermal regulation process, cooling of electronic devices, and security of energy systems. Hydro magnetic flow is encountered in heat exchangers, pumps, flow meters, in designing communications and radar systems, and in nuclear engineering in connection with the cooling of reactor and MHD accelerators. Convective heat transfer in porous media has

received considerable attention in recent years owing to its importance in various technological applications such as fibre and granular insulation, electronic system cooling, cool combustors, and porous material regenerative heat exchangers.

Gupta et al. [1] have studied free convection on flow past an linearly accelerated vertical plate in the presence of viscous dissipative heat using perturbation method. Kafousias and Raptis [2] extended this problem to include mass transfer effects subjected to variable suction or injection. Free convection effects on flow past an accelerated vertical plate with variable suction and uniform heat flux in the presence of magnetic field was studied by Raptis et al. [3]. Mass transfer effects on flow past an uniformly accelerated vertical plate was studied by Soundalgekar [4]. Singh [5] studied MHD free convection flow in the stokes problem for a porous vertical plate. Mass transfer effects on flow past an accelerated vertical plate with uniform heat flux was analyzed by Singh and

Singh [6]. Basant kumar Jha and Ravindra Prasad [7] analyzed mass transfer effects on the flow past an accelerated infinite vertical plate with heat sources. Again Basant kumar Jha [8] discussed MHD free convection and mass transform flow through a porous medium. Recently Muthucumaraswamy et al. [9] studied unsteady flow past an accelerated infinite vertical plate with variable temperature and uniform mass diffusion.

The hydro magnetic free convection flow past an accelerated vertical porous plate with variable temperature through a porous medium has many technical applications. Hence it is proposed to study MHD free convection flow past an accelerated vertical porous plate with variable temperature through a porous medium. The dimensionless governing equations are solved using the Laplace transform technique.

MATHEMATICAL ANALYSIS

An unsteady flow of an electrically conducting viscous incompressible fluid past an infinite vertical porous plate with variable temperature through porous medium has been considered. A magnetic field of uniform strength is assumed to be applied transversely to the porous plate. The magnetic Reynolds number of the flow is taken to be small enough so that the induced magnetic field can be neglected. The flow is assumed to be in x' - direction which is taken along the vertical plate in the up ward direction. The y' -axis is taken to be normal to the plate. Initially the plate and the fluid are at the same temperature T'_∞ . At time $t' > 0$, the plate is accelerated with a velocity $u' = u_0 t'$ in its own plane and the plate temperature is raised linearly with time t. It is assumed that the effect of viscous dissipation is negligible. Then by usual Boussinesq's approximation, the governing equations for the unsteady flow are

$$\frac{\partial u'}{\partial t'} + v' \frac{\partial u'}{\partial y'} = g\beta(T' - T'_\infty) + \nu \frac{\partial^2 u'}{\partial y'^2} - \frac{\sigma B_0^2 u'}{\rho} - \frac{\nu u'}{K} \quad (1)$$

$$\rho C_p \left(\frac{\partial T'}{\partial t'} + v' \frac{\partial T'}{\partial y'} \right) = \kappa \frac{\partial^2 T'}{\partial y'^2} \quad (2)$$

With the initial and boundary conditions $t' \leq 0, u' = 0, T' = T'_\infty$ for all y' (3)

$t' > 0, u' = u_0 t', T' = T'_\infty + (T'_w - T'_\infty) A t'$ at $y' = 0$
 $u' = 0, T' \rightarrow T'_\infty$ as $y' \rightarrow \infty$.

where $A = \left(\frac{u_0^2}{\nu} \right)^{\frac{1}{3}}$

Equation (1) is valid when the magnetic lines of force are fixed relative to the fluid.

On introducing the following non-dimensional quantities:

$$u = \frac{u'}{(\nu u_0)^{\frac{1}{3}}}, t = t' \left(\frac{u_0^2}{\nu} \right)^{\frac{1}{3}}, y = y' \left(\frac{u_0}{\nu^2} \right)^{\frac{1}{3}},$$

$$\theta = \frac{T' - T'_\infty}{T'_w - T'_\infty}, P_r = \frac{\mu C_p}{\kappa}, M = \frac{\sigma B_0^2 \nu^{\frac{1}{3}}}{\rho u_0^{\frac{2}{3}}}, \quad (4)$$

$$G_r = \frac{g\beta(T'_w - T'_\infty)}{u_0}, \gamma = \frac{-v'}{(\nu u_0)^{\frac{1}{3}}}, K = K' \left(\frac{u_0}{\nu^2} \right)^{\frac{2}{3}}$$

in equations (1) to (3), leads to

$$\frac{\partial u}{\partial t} - \gamma \frac{\partial u}{\partial y} = G_r \theta + \frac{\partial^2 u}{\partial y^2} - Mu - \frac{u}{K} \quad (5)$$

$$P_r \left(\frac{\partial \theta}{\partial t} - \gamma \frac{\partial \theta}{\partial y} \right) = \frac{\partial^2 \theta}{\partial y^2} \quad (6)$$

With the initial and boundary conditions :

$t \leq 0: u = 0, \theta = 0$ for all y
 $t > 0: u = t, \theta = t$ at $y = 0$ (7)
 $u = 0, \theta \rightarrow 0$ as $y \rightarrow \infty$

All the physical variables are defined in the nomenclature. The solution of equations (5) and (6), subject to the boundary conditions (7) by the laplace transform technique when the prandtl number $P_r = 1$, is given by

$$u = \left(1 - \frac{G_r}{M} \right) \frac{t}{2} \left[e^{y \left[\frac{\sqrt{d}-\gamma}{2} \right]} \operatorname{erfc} \left(\frac{y+2\sqrt{d}}{2\sqrt{t}} \right) + e^{-y \left[\frac{\sqrt{d}+\gamma}{2} \right]} \operatorname{erfc} \left(\frac{y-2\sqrt{d}}{2\sqrt{t}} \right) \right] - \frac{y}{4\sqrt{d}} \left[1 - \frac{G_r}{M} \right] \left[e^{-y \left[\frac{\sqrt{d}+\gamma}{2} \right]} \operatorname{erfc} \left(\frac{y-2\sqrt{d}}{2\sqrt{t}} \right) - e^{y \left[\frac{\sqrt{d}-\gamma}{2} \right]} \operatorname{erfc} \left(\frac{y+2\sqrt{d}}{2\sqrt{t}} \right) \right] + \frac{G_r t}{2M'} \left[\operatorname{erfc} \left(\frac{y+t\gamma}{2\sqrt{t}} \right) + e^{-\gamma y} \operatorname{erfc} \left(\frac{y-t\gamma}{2\sqrt{t}} \right) \right] - \frac{G_r y}{2M' \gamma} \left[e^{-\gamma y} \operatorname{erfc} \left(\frac{y-t\gamma}{2\sqrt{t}} \right) - \operatorname{erfc} \left(\frac{y+t\gamma}{2\sqrt{t}} \right) \right] \quad (8)$$

$$\theta = \frac{t}{2} \left[\operatorname{erfc} \left(\frac{y+t\gamma}{2\sqrt{t}} \right) + e^{-\gamma y} \operatorname{erfc} \left(\frac{y-t\gamma}{2\sqrt{t}} \right) \right] - \frac{y}{2\gamma} \left[e^{-\gamma y} \operatorname{erfc} \left(\frac{y-t\gamma}{2\sqrt{t}} \right) - \operatorname{erfc} \left(\frac{y+t\gamma}{2\sqrt{t}} \right) \right] \quad (9)$$

where $M' = M + \frac{1}{K}$, $d = M' + \frac{\gamma^2}{4}$

SKIN-FRICTION

We now study skin-friction from velocity field. It is given in non-dimensional form as

$$\tau = \left. \frac{-du}{dy} \right|_{y=0} \quad (10)$$

Then from equations (8) and (10), we have

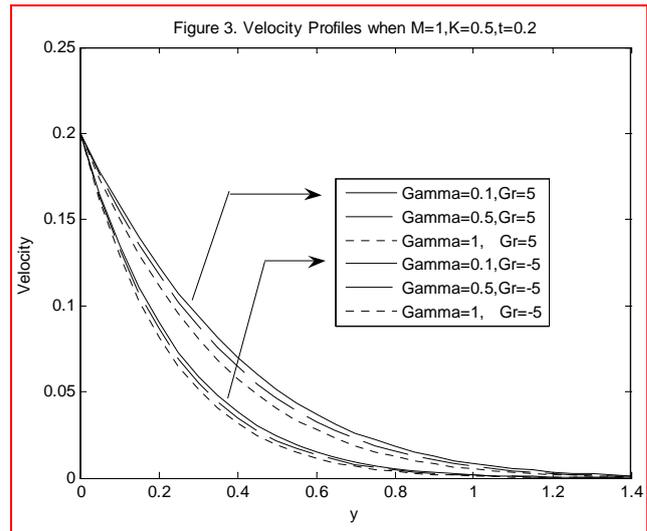
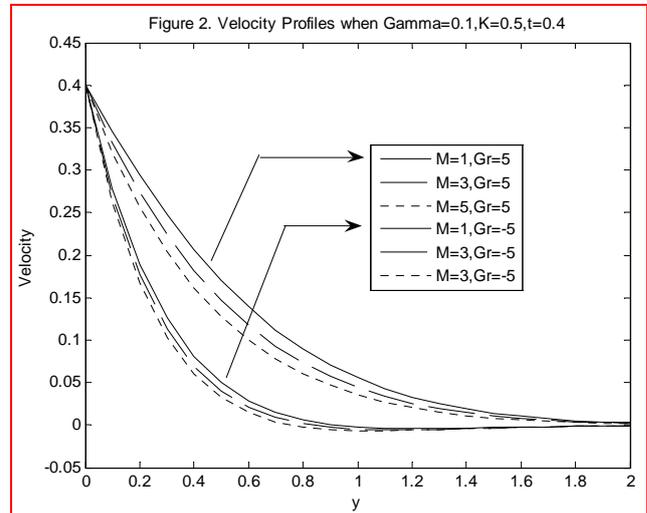
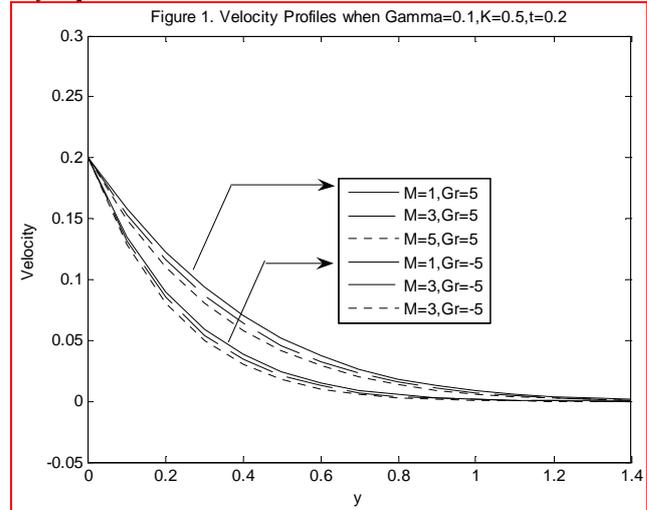
$$\begin{aligned} \tau = & \left[1 - \frac{G_r}{M'} \right] \left[\sqrt{\frac{t}{\pi}} e^{-td} + t\sqrt{d} \operatorname{erf}(\sqrt{td}) \right] \\ & + \left[1 - \frac{G_r}{M'} \right] \frac{t\gamma}{4} \left[\operatorname{erfc}(\sqrt{td}) + \operatorname{erfc}(-\sqrt{td}) \right] \\ & + \left[1 - \frac{G_r}{M'} \right] \frac{1}{2\sqrt{d}} \operatorname{erf}(\sqrt{td}) + \frac{G_r}{\gamma M'} \operatorname{erf} \left(\frac{\gamma\sqrt{t}}{2} \right) \\ & + \frac{tG_r}{2M'} \left[\frac{2}{\sqrt{\pi t}} e^{-\frac{t\gamma^2}{4}} + \gamma \operatorname{erfc} \left(-\frac{\gamma\sqrt{t}}{2} \right) \right] \quad (11) \end{aligned}$$

DISCUSSION AND RESULTS

In order to get the physical insight into the problem, we have plotted velocity profiles for different parameters M (Magnetic parameter), K (permeability parameter), γ (suction parameter) and G_r , (thermal grashof number) in figures (1) to (8) for the cases of heating ($G_r < 0$) and cooling ($G_r > 0$) of the plate. The heating and cooling take place by setting up free convection current due to temperature gradient.

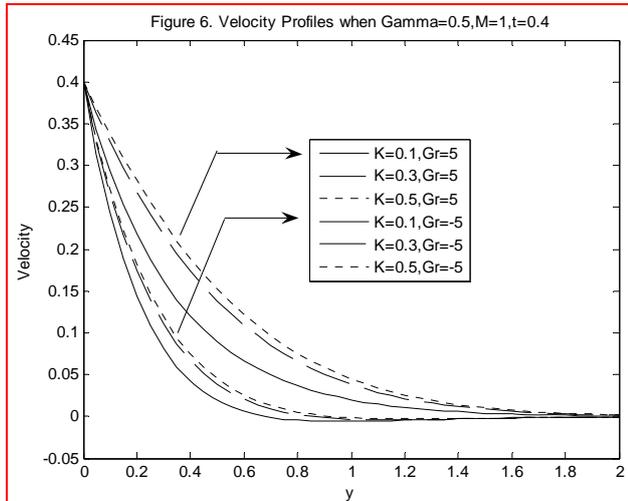
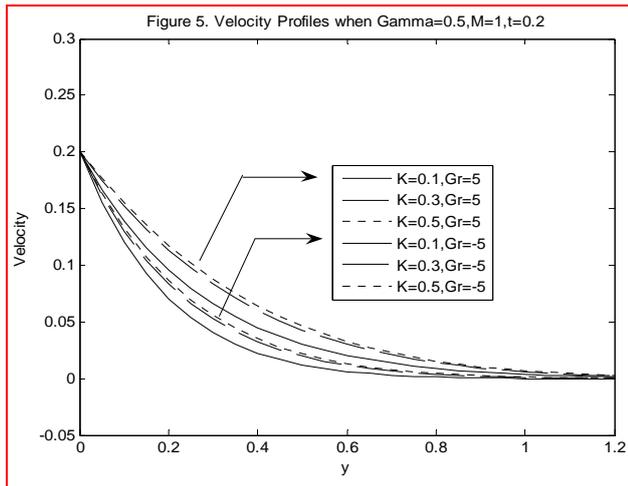
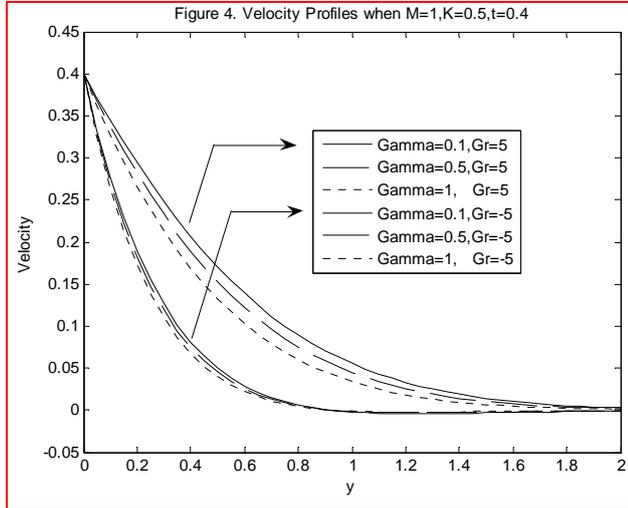
Figures (1) and (2) illustrate the influences of M (magnetic parameter) in cases of cooling and heating of the porous plate at $t=0.2$ and $t=0.4$ respectively. It is observed that the velocity decreases with increase of magnetic parameter M for both cases of cooling and heating of the plate. It is because that, the application of transverse magnetic field will result a resistive type force(lorentz force) similar to drag force, which tends to resist the fluid flow and thus reducing its velocity. It is also observed that the

velocity is maximum near the plate and decreases away from the plate and finally takes asymptotic value.



Figures (3) and (4) reveal velocity variations with γ (suction parameter) in cases of cooling and heating of the porous plate at $t=0.2$ and $t=0.4$ respectively. It is found that the velocity

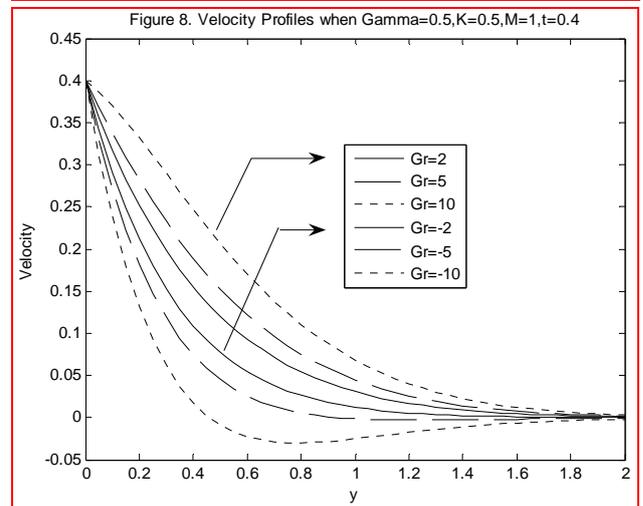
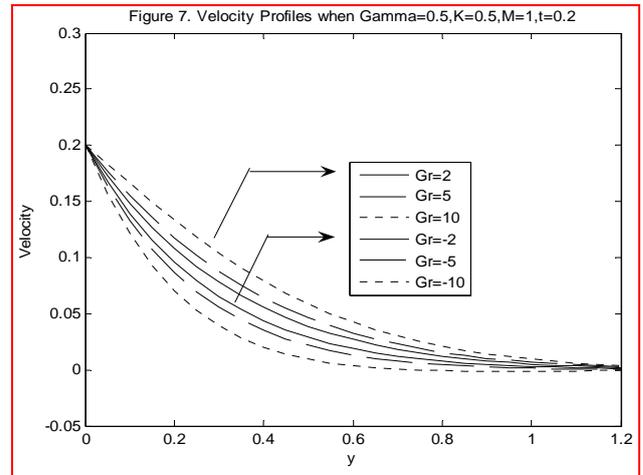
decreases as the suction parameter γ increases for both cases of cooling and heating of the porous plate. It is also found that the velocity is maximum near the plate and decreases away from the plate and finally takes asymptotic value.

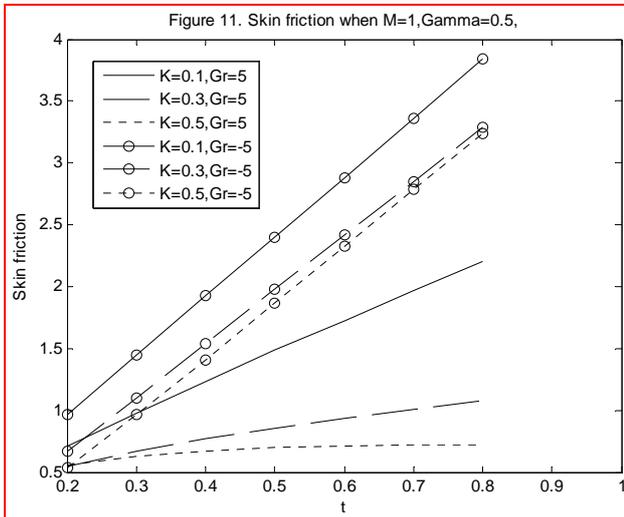
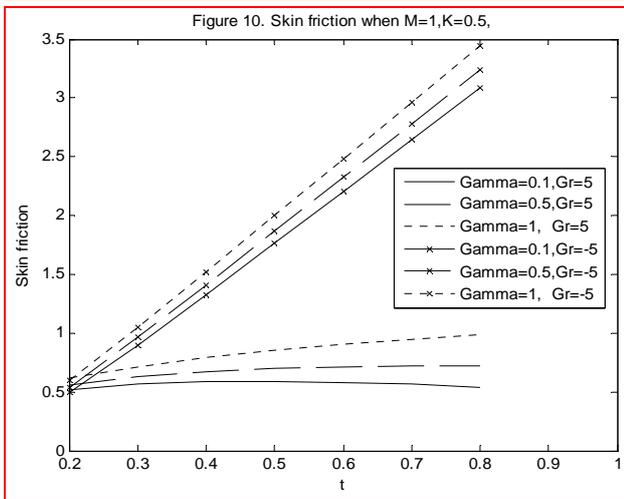
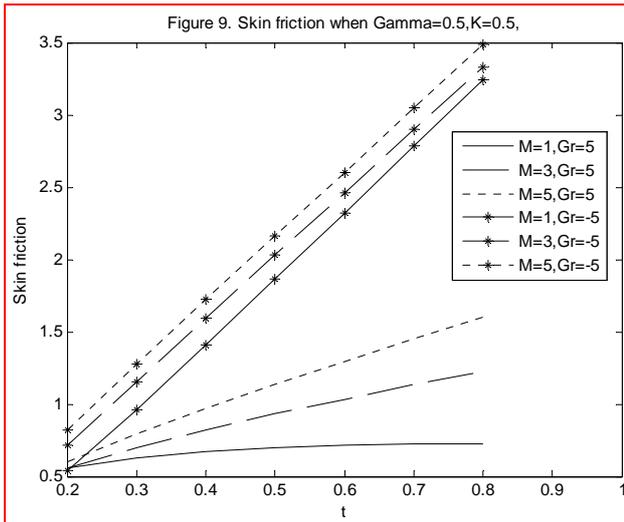


Figures(5) and (6) represent the velocity profiles due to variations in K (permeability parameter) in cases of cooling and heating of the porous

plate at $t=0.2$ and $t=0.4$ respectively. It is observed that the velocity increases with increase of permeability parameter K for both cases of cooling and heating of the plate. This is due to the fact that the presence of a porous medium increases the resistance to flow. It is also observed that the velocity is maximum near the plate and decreases away from the plate and finally takes asymptotic value.

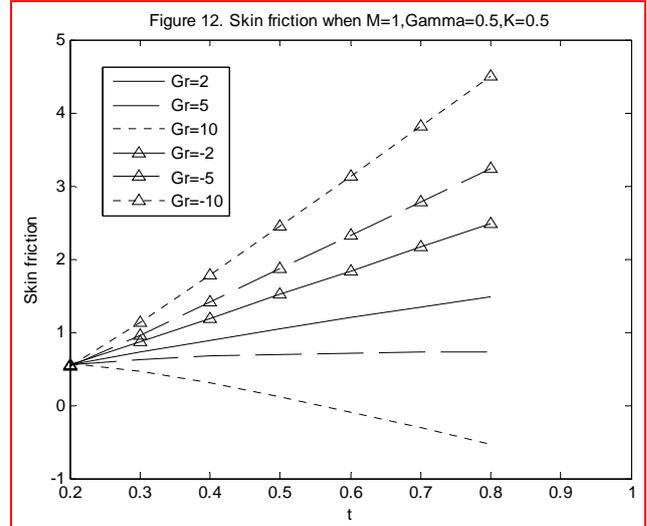
Figures (7) and (8) reveal velocity variations with G_r (thermal grashof number) in the cases of cooling and heating of the porous plate at $t=0.2$ and $t=0.4$ respectively. It is observed that the velocity increases with increase of thermal grashof number G_r in the case of cooling of the plate. It is due to the fact increase in the values of thermal grashof number has the tendency to increase the thermal buoyancy effect. This gives rise to an increase in the induced flow. But the reverse effect is observed in case of heating of the plate. It is also observed that the velocity is maximum near the plate and decreases away from the plate and finally takes asymptotic value.





The skin friction is presented in figures (9) to (12). From these figures we conclude that the skin-friction increases with increase in M (Magnetic parameter) and γ (suction parameter), but decreases with an increase in K (permeability parameter) for both cooling and heating of the porous plate. It is also observed that skin-friction decreases with increase in

G_r (Thermal Grashof number) for cooling of the porous plate. But the reverse effect is observed in the case of heating of the porous plate.



ACKNOWLEDGEMENTS

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Nomenclature

- A Constant
- y' Coordinate axis normal to the plate
- y Dimensionless coordinate axis normal to the plate
- u Dimensionless velocity
- B_0 External magnetic field
- P_r Prandtl number
- C_p Specific heat at constant pressure
- T'_∞ Temperature of the fluid far away from the plate
- T' Temperature of the fluid near the plate
- T'_w Temperature of the plate
- κ Thermal conductivity of the fluid
- G_r Thermal Grashof number
- t' Time
- u' Velocity of the fluid in the x' -direction
- v' Velocity of the fluid in the y' -direction
- u_0 Velocity of the plate
- g Acceleration due to gravity
- K permeability parameter

M Magnetic field parameter
 t Dimensionless time
 Greek symbols
 μ Coefficient of viscosity
 $erfc$ Complementary error function
 ρ Density of the fluid
 γ Suction Parameter
 τ Dimensionless skin friction
 θ Dimensionless temperature
 σ Electric conductivity
 erf Error function
 ν Kinematic viscosity
 α Thermal diffusivity
 β Volumetric coefficient of thermal expansion
 Subscripts
 w Conditions on the wall
 ∞ Free stream conditions

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FLUID FLOW INDUCED BY A MOBILE PROFILE WITH NON-CONSTANT CIRCULATION

■ **Abstract:**

This paper deals with an approach of the inviscid 2-dimensional fluid flow induced by the rototranslation of a profile (with a cuspidal point) in the fluid mass, by accepting a non-constant circulation $\Gamma(t)$ around the profile, i.e., multiformity for the pressure field. Some aerodynamic characteristics of a flow induced by an oscillatory motion of a Joukovski profile are calculated.

■ **Keywords:**

Non-constant circulation; Joukovski J010 Airfoil

■ **GENERALITIES ON THE UNSTEADY FLOW
INDUCED BY A MOBILE PROFILE**

Let us consider the two-dimensional unsteady irrotational flow of an inviscid incompressible fluid, induced by the motion of a (wing) profile c with a cuspidal point at the trailing edge, the fluid being supposed at rest at infinity. The contour of the profile c is a simple, closed rectifiable curve ∂c while the exterior mass forces are neglected.

By considering a fixed of rectangular coordinates Ox_1y_1 together with a mobile frame Oxy linked to the mobile profile, we denote at every time t , by

$$\alpha(t) = (\widehat{O_1x_1}, Ox)$$

by $z_0 = x_0 + iy_0$ the affix of the origin of the system Oxy which has the velocity $\vec{v}_0(u_0, v_0)$, by $\vec{r} = x\vec{i} + y\vec{j} = x_1\vec{i}_1 + y_1\vec{j}_1$ the position vector \vec{r} of an arbitrary point $M \in \text{ext}(c)$ while (\vec{i}, \vec{j}) and (\vec{i}_1, \vec{j}_1) are the unit vectors of the mobile and fixed coordinates system respectively, by $\vec{\omega}(0, 0, \omega)$ the instantaneous rotation of the mobile frame. We can write that the absolute

velocity, \vec{v} , of a fluid particle, located at $M(\vec{r})$, is given by $\vec{v} = u\vec{i} + v\vec{j} = \vec{v}_t + \vec{v}_r$,

where $\vec{v}_t = v_0 + \vec{\omega} \times \vec{r}$ is the transport velocity while $\vec{v}_r = u_r\vec{i} + v_r\vec{j} = \dot{x}\vec{i} + \dot{y}\vec{j}$ is the relative velocity of the fluid particle M .

Concerning the fluid flow equations (within the mobile frame Oxy), denoting by p, ρ, V the pressure, the mass density and the magnitude of the absolute velocity respectively, they are

$$\begin{cases} \frac{\partial \vec{v}}{\partial t} + \text{grad} \left(\frac{1}{2} V^2 - \vec{v} \cdot \vec{v}_t \right) + \frac{1}{\rho} \text{grad} p = 0 \\ \text{div} \vec{v} = 0 \\ \text{rot} \vec{v} = 0 \end{cases}$$

In what follows we will accept the multiformity of the pressure field which leads to a period of the pressure around the profile and implicitly to a non-constant circulation $\Gamma(t)$ around the contour ∂c .

By introducing the complex potential $f(z; t) = \varphi(x, y; t) + i\psi(x, y; t)$ and the complex

velocity $w = f'(z) = u - iv$, where $u = \frac{\partial \varphi}{\partial x} = \frac{\partial \psi}{\partial y}$ and

$v = \frac{\partial \varphi}{\partial y} = -\frac{\partial \psi}{\partial x}$, for solving the above proposed

flow problem, we are led to the following boundary value problem for the complex potential:

Find the function $f : d \equiv \text{ext}(c) \rightarrow C$ so that

1. $f(z; t)$ is holomorphic in the unbounded domain d , $\forall t > 0$,
2. $w(z, t) = f'(z, t)$ is a uniform holomorphic function in d and $\lim_{|z| \rightarrow \infty} w(z) = 0$,
3. $\text{Im}\{f(z, t)\} \equiv \psi$ is continuous on ∂c and

$$\psi(x, y; t)|_{\partial c} = u_0(t) \cdot y - v_0(t) \cdot x - \omega(t) \cdot \frac{x^2 + y^2}{2}.$$

In order to solve this problem we will follow the classical conformal mapping technique. Denoting by

$$H : D \rightarrow d, z = H(Z) = a_\infty Z + a_0 + \frac{a_1}{Z} + \frac{a_2}{Z^2} + \dots$$

the conformal mapping which applies the exterior D of a circumference C of centre O and radius R , i.e., $C(O, R)$, of the plane OXY ($Z = X + iY$), onto the physical flow domain d , the transformed complex potential $F(Z; t) = f(H(Z)) = \Phi(X, Y; t) + i\Psi(X, Y; t)$ becomes a holomorphic function in $D \equiv \text{ext}(C)$ which is regular at infinity and whose imaginary part $\Psi = \text{Im}\{F(Z; t)\}$ on the circumference satisfies

$$\Psi|_c = u_0 y(X, Y) - v_0 x(X, Y) - \omega \frac{x^2(X, Y) + y^2(X, Y)}{2} \Big|_{\partial c}$$

where $x(X, Y) + iy(X, Y) = H(X + iY)$.

But this exterior Dirichlet problem for a circle could be solved by considering the Schwartz-Villat formula for determining the flow with circulation $\Gamma(t)$, i.e.,

$$F(Z; t) = -\frac{1}{\pi c} \int \Psi(\zeta) \frac{d\zeta}{\zeta - Z} + \frac{\Gamma(t)}{2\pi i} \text{Log} \frac{Z}{R}.$$

Assuming that the cuspidal point at the trailing edge of our profile with the affix $b = x_b + iy_b$ corresponds to the point $Z = R$ of the plane Z , the involved conformal mapping could be represented in the form

$$z = H(Z) = b + (Z - R)^2 \cdot q(Z), \quad q(R) \neq 0,$$

and its derivative by $H'(Z) = (Z - R)q_1(Z)$ where

$$q_1(Z) = 2q(Z) + (Z - R)q'(Z).$$

Following now the Couchet way [2] for a complete determining of the complex potential of the flow, we will express the unknown complex potential $F(Z)$ under the form:

$$F(Z; t) = u_0(t)F_1(Z) + v_0(t)F_2(Z) + \omega(t)F_3(Z) + \Gamma(t)F_4(Z)$$

where $F_1(Z) = H(Z) - a_\infty Z - a_0 - \frac{a_\infty R^2}{Z}$,

$$F_2(Z) = -i \left[H(Z) - a_\infty Z - a_0 - \frac{a_\infty R^2}{Z} \right],$$

$$F_3(Z) = \frac{1}{2\pi c} \int \frac{r^2(\zeta)}{\zeta - Z} d\zeta,$$

where $r^2(\zeta) = x^2(\zeta) + y^2(\zeta) = H(\zeta) \cdot \overline{H(\zeta)}$ and

$$\Omega(Z) = \frac{1}{2i} F_3'(Z) = \frac{1}{4\pi i c} \int \frac{dr^2(\zeta)}{\zeta - Z},$$

$$F_4(Z) = \frac{1}{2\pi i} \text{Log} \frac{Z}{R}.$$

Considering the complex velocity

$$w(z; t) = \frac{df(z; t)}{dz} = \frac{dF(Z; t)}{dZ} \cdot \frac{1}{H'(Z)},$$

by imposing the Joukovski rule (at the image of the cuspidal point) $\left. \frac{dF(Z; t)}{dZ} \right|_{Z=R} = 0$, we get the

necessary value of the circulation $\Gamma(t)$, namely, $\Gamma(t) = 4\pi R(a_\infty v_0 + \Omega \cdot \omega)$.

The velocity expression $(u - iv)$ becomes $u_0 K + v_0 L + \omega M$, where

$$K = 1 - \frac{a_\infty (Z^2 - R^2)}{Z^2 \cdot H'(Z)},$$

$$L = -i \left[1 - \frac{a_\infty}{Z^2 \cdot q_1(Z)} (Z - R) \right],$$

$$M = \frac{2i}{Z q_1(Z)} \frac{Z \Omega(Z) - R \Omega(R)}{Z - R}.$$

The velocity value at the trailing edge $Z = R$ is

$$w(b) = u_0 \left[1 - \frac{2a_\infty}{R q_1(R)} \right] - iv_0 + \omega \frac{2i(\Omega + R\Omega')}{R q_1(R)},$$

where $\Omega = \Omega(R)$ and $\Omega' = \Omega'(R)$.

THE CASE OF JOUKOVSKI TYPE PROFILE

Let us now consider the particular case of a Joukovski type profile. To make precise by using a conformal mapping of the type

$$z = H(Z) = a_0 + Z + \frac{(1 - X_0)^2}{Z - X_0}, \quad 0 < X_0 < 1,$$

the image of the circumference $C(O, R)$ of the plane Z becomes the considered Joukovski profile whose rototranslation induces the fluid flow. We denote by AB ($A(a, 0)$, $B(b, 0)$), $a = H(-1)$, $b = H(1)$, the profile chord, its trailing edge (cuspidal point) being $z = b = H(1)$.

Using the development

$$H(Z) = Z + a_0 + \frac{(1 - X_0)^2}{Z} + \frac{X_0(1 - X_0)^2}{Z^2} + \frac{X_0^2(1 - X_0)^2}{Z^3} + \dots$$

we find $a_\infty = 1$, $a_1 = (1 - X_0)^2$ and

$$H'(Z) = \frac{Z+1-2X_0}{(Z-X_0)^2} (Z-1).$$

We also obtain the expressions

$$\Omega(Z) = \frac{1}{2} \left[\frac{a_0 + a_0(1-X_0)^2}{Z^2 + (Z-X_0)^2} + \frac{(1-X_0)^2(2Z-X_0)}{Z^2(Z-X_0)^2} + \frac{X_0(1-X_0)^3}{(1+X_0)(Z-X_0)^2} \right]$$

$$\Omega = \Omega(1) = a_0 + \frac{1+X_0-X_0^2}{1+X_0}.$$

The circulation and the complex potential are, respectively,

$$\Gamma = 4\pi \left[v_0 + \omega \left(\frac{a_0}{2} + \frac{1+X_0-X_0^2}{1+X_0} \right) \right]$$

$$F(t,Z) = u_0 \left[\frac{(1-X_0)^2}{Z-X_0} - \frac{1}{Z} \right] - iv_0 \left[\frac{(1-X_0)^2}{Z-X_0} + \frac{1}{Z} \right] -$$

$$-i\omega \left[\frac{a_0}{Z} + \frac{a_0(1-X_0)}{Z-X_0} + \frac{(1-X_0)^2}{Z(Z-X_0)} + \frac{X_0(1-X_0)^3}{(1+X_0)(Z-X_0)} \right] -$$

$$-2i \left[v_0 + \omega \left(\frac{a_0}{2} + \frac{1+X_0-X_0^2}{1+X_0} \right) \right] \cdot \text{Log} Z.$$

Consequently the complex velocity $u - iv = u_0K + v_0L + \omega M$, where

$$K(Z) = 1 - \frac{Z+1}{Z} \cdot \frac{(Z-X_0)^2}{Z+1-2X_0},$$

$$L(Z) = -i \left[1 - \frac{(Z-X_0)^2(Z-1)}{Z^2(Z+1-2X_0)} \right],$$

$$M(Z) = \frac{2i}{Z} \cdot \frac{(Z-X_0)^2}{Z+1-2X_0} \cdot \frac{Z\Omega(Z) - \Omega(1)}{Z-1}$$

$$\frac{Z\Omega(Z) - \Omega(1)}{Z-1} = -\frac{a_0}{2} \left[\frac{1}{Z} + \frac{Z-X_0^2}{(Z-X_0)^2} \right] +$$

$$\frac{2(X_0^2 - X_0 - 1)Z^2 - (X_0^4 + X_0^3 - 3X_0^2 - 3X_0 + 2)Z + X_0(1-X_0)^2(1+X_0)}{2(1+X_0)Z(Z-X_0)^2}.$$

Putting then $Z = 1$ we have $K = X_0$, $L = -i$,

$$M = i(1-X_0) \cdot \lim_{Z \rightarrow 1} \frac{Z\Omega(Z) - \Omega(1)}{Z-1} = -i(2+a_0-X_0)$$

and the value of the velocity at the trailing edge is $u - iv|_{Z=1} = X_0u_0 - iv_0 - i(2+a_0-X_0)\omega$.

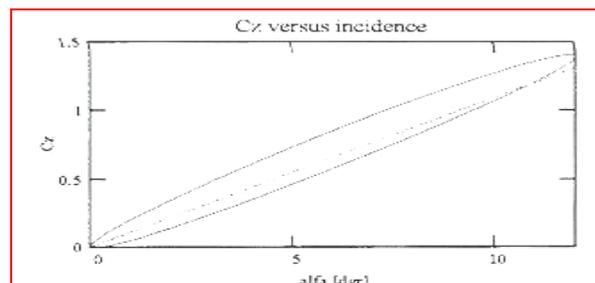
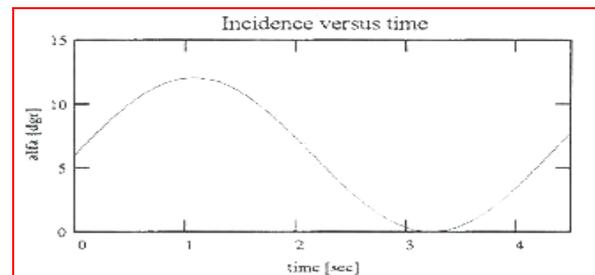
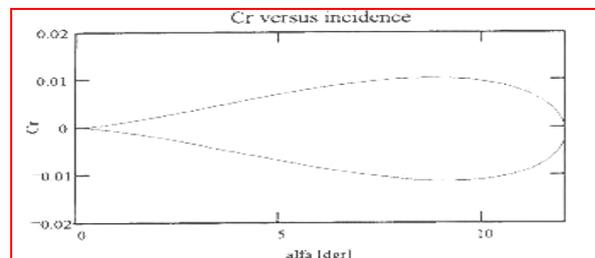
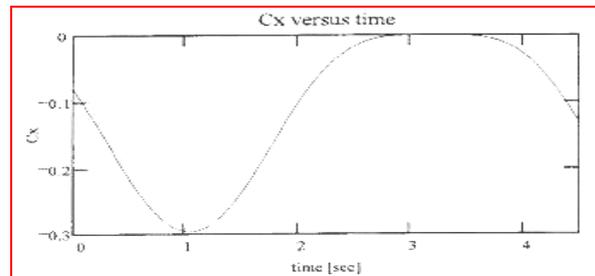
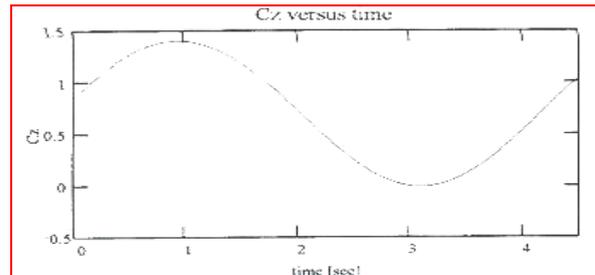
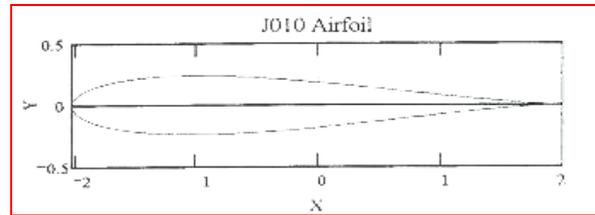
The non-constant circulation $\Gamma(t)$ implies a multiform pressure field, the pressure admitting a period around the profile. So, from Bernoulli formula we obtain

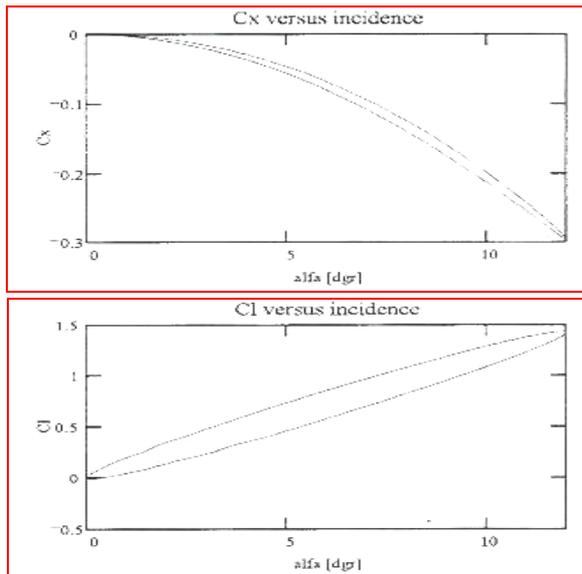
$$\int_c dp = -\rho \frac{d\Gamma}{dt} = -4\pi\rho \left(\frac{dv_0}{dt} + \Omega \frac{d\omega}{dt} \right).$$

Mach = 0.112, k = 0.077

a = 6 + 10 * sin(1.461 * t)

FIGURE 1. Aerodynamic coefficients for oscillating Joukovski J010 airfoil





According to the Blasius-Chaplin formulas and imposing the Joukovski rule we obtain the pressure resultant components and the moment magnitude, i.e.

$$R_x = 2\pi\rho \left[\begin{array}{l} -2v_0^2 + (B_1 - 2a_0 - 2\Omega)v_0\omega \\ + (C_1 - 2a_0\Omega)\omega^2 + A_1 \frac{dv_0}{dt} \end{array} \right]$$

$$R_y = 2\pi\rho \left[\begin{array}{l} 2u_0v_0 + (A_1 + 2\Omega)u_0\omega - (4 + B_1 - 2X_0) \frac{dv_0}{dt} \\ - (C_1 + 4\Omega - 2X_0\Omega) \frac{d\omega}{dt} \end{array} \right]$$

$$M_0 = -\rho \left[\begin{array}{l} 2\pi(A_1 + B_1 - 2a_0)u_0v_0 - 4\pi a_0\Omega u_0\omega \\ + (2\pi C_1 + Q) \frac{dv_0}{dt} + (\pi P + Q\Omega) \frac{d\omega}{dt} \end{array} \right]$$

where $A_1 = \frac{A}{2i\pi}$, $B_1 = \frac{B}{2\pi}$, $C_1 = \frac{C}{2\pi}$ and

$$A = 2i\pi[(1 - X_0)^2 - 1] + i \frac{4\pi X_0}{(1 + X_0)^2} = -2i\pi \frac{X_0^2(3 - X_0^2)}{(1 + X_0)^2}$$

$$B = 2\pi[(1 - X_0)^2 - 1] - \frac{4\pi X_0}{(1 + X_0)^2} = 2\pi \frac{X_0^4 - X_0^2 + 2}{(1 + X_0)^2}$$

$$C = 2\pi a_0[(1 - X_0)^2 + 1] + 2\pi X_0 \frac{(1 - X_0)^3}{1 + X_0}$$

$$- \frac{4\pi X_0}{(1 + X_0)^2} \left[a_0 - \frac{(1 - X_0)^2}{2(1 + X_0)} \right]$$

$$Q = 4\pi a_0 + 4\pi a_0(1 - X_0) + 4\pi(1 - X_0) + 4\pi X_0 \frac{(1 - X_0)^2}{1 + X_0}$$

The final diagrams of this paper (figure 1) present the numerical results calculated with the above method for the symmetrical Joukovski J010 airfoil in an oscillating motion defined by the oscillation angle $\alpha(t) = \alpha_0 + A_m \cdot \sin \frac{kV}{a} t$,

where $a = |AB|/2$, $k = 0,077$, $V = 340 \cdot \text{Mach}$.

We denoted $C_x = \frac{R_x}{\rho a V^2}$, $C_z = \frac{R_y}{\rho a V^2}$, $C_r = \frac{R_{x1}}{\rho a V^2}$,

$C_1 = \frac{R_{y1}}{\rho a V^2}$. where $R_{x1} = R_x \cos \alpha + R_y \sin \alpha$ and

$R_{y1} = -R_x \sin \alpha + R_y \cos \alpha$.

The continuous line represents our results and the dotted line in the diagram “ C_z versus incidence”, represents the results obtained in the paper [4].

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AN IMAGE RECONSTRUCTION AND ENHANCEMENT TECHNIQUE FOR MICROWAVE TOMOGRAPHY

■ Abstract:

An inverse iterative algorithm for microwave imaging based on moment method solution is presented here. This algorithm is based on Levenberg-Marquardt method. Different mesh size of the model has been used here to overcome the inverse crime. The reconstructed image is then processed through different image enhancement tools.

■ Keywords:

regularization, microwave tomography, Levenberg-Marquardt method, inverse crime, image processing

■ INTRODUCTION

Microwave tomography techniques for biomedical applications have been subject to intensive research during the last few decades. The objective of microwave tomography is to reconstruct the dielectric properties of a body illuminated with microwaves from a measurement of the scattered fields. Additional advantages include the fact that the probing radiation is not harmful at the low powers employed. As the human body exhibits large variations in the dielectric properties of its various tissue types, microwave tomography is expected to give information on the distribution of tissue types within the body in image form.

Apart from our first generation algorithms [4, 5], we had proposed several algorithms [1, 2, 3, 6] which reconstructed the image without any misfit under noise-free environment. However, in the above stated algorithms, the mesh size remains the same both in the forward problem and the inverse problem leading to inverse crime. In this paper, an iterative algorithm based on Levenberg-Marquardt regularization technique with necessary considerations to

avoid inverse crime has been proposed. The reconstructed image is then undergone through several image enhancement mechanisms to reduce the noise.

■ FORWARD PROBLEM

The structure of the forward problem is same as that of our previous work [6]. A cylindrical object of arbitrary cross section is considered here which is characterized by a complex permittivity distribution $\epsilon(x,y)$.

An electromagnetic wave radiated from an open-ended waveguide is used here for the illumination. The incident electric field E^{inc} is parallel to the axis of the cylinder.

The expression for the total electric field E is

$$\vec{E} = \vec{E}^{inc} + \vec{E}^s \quad (1)$$

where E_s represents the scattered field which is generated by the equivalent electric current radiating in free space.

The total electric field can be calculated with an integral representation

$$\vec{E}(x,y) = \vec{E}^{inc}(x,y) + \int_s \vec{J}_s(x,y) G(x,y;x',y') dx'dy' \quad (2)$$

where the Green's function can be given by

$$G(\mathbf{x}, \mathbf{y}; \mathbf{x}', \mathbf{y}') = -\frac{j}{4} H_0^2 \left(k \sqrt{(\mathbf{x} - \mathbf{x}')^2 + (\mathbf{y} - \mathbf{y}')^2} \right) \quad (3)$$

Here (\mathbf{x}, \mathbf{y}) and $(\mathbf{x}', \mathbf{y}')$ are the observation and source points respectively.

The solution of the forward are carried out by moment method [7] using pulse-basis function and point matching technique.

INVERSE PROBLEM

The aim of the inverse problem is to find a stable solution for permittivity distribution ϵ^* which minimizes the squared error output at the receivers i.e.

$$\|E(\epsilon) - \mathbf{e}\|_2^2 \quad (4)$$

where $\mathbf{e} \in \mathbb{C}^n$, the n electric fields we measure at receiver points, $E: \mathbb{C}^m \rightarrow \mathbb{C}^n$, a function mapping the complex permittivity distribution with m degrees of freedom into a set of n approximate electric field observations, and also $\epsilon \in \mathbb{C}^m$, the complex permittivity distributions with m degrees of freedom.

The details of the Levenberg-Marquardt regularization technique has already been discussed in our earlier work [6]. The Levenberg-Marquardt regularization technique for the minimization of the (4) leads to an iterative solution

$$\epsilon_{i+1} = \epsilon_i + \Delta \epsilon_i \quad (5)$$

where ϵ_{k+1} is the permittivity distribution at the $k+1^{th}$ iteration.

$\Delta \epsilon$ can be written as

$$\Delta \epsilon = (E'(\epsilon) \dagger E'(\epsilon) + \lambda I)^{-1} E'(\epsilon) \dagger (E(\epsilon) - \mathbf{e}) \quad (6)$$

where E' is the Jacobian matrix, \dagger denotes the conjugate transpose, λ is a monotonically decreasing regularization parameter, I is the identity matrix, $E(\epsilon)$ is the calculated electric fields at the receivers.

NUMERICAL MODEL

The theoretical model used to test our algorithm is shown in Figure 1.

It is a high contrast square biological object $9.6 \text{ cm} \times 9.6 \text{ cm}$ consisting of muscle and bone having complex dielectric constants $50-j23$ and $8-j1.2$ respectively at a frequency of 1 GHz . The object is kept immersed in saline water having complex dielectric constant $76-j40$.

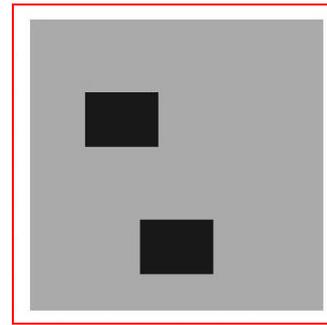


Figure1. Numerical model

The target is illuminated with TE fields radiating from an open ended dielectric filled wave guide having sinusoidal aperture field distribution. The transmitter is moved along four mutually orthogonal directions. For each of the transmitter positions along a particular transmitting plane, the received fields at eighteen locations in the other three orthogonal planes were measured theoretically at a frequency of 1 GHz

If the same meshes are used both in the simulation of the measured data and in the solution of inverse problem, we may commit a so-called inverse crime, where numerical errors may be cancelled out inadvertently. To avoid inverse crime, different meshes are used as shown in figure 2. The finer mesh is used in the forward problem (Figure 2(a)) whereas the inverse solver uses the coarse mesh (Figure 2 (b)).

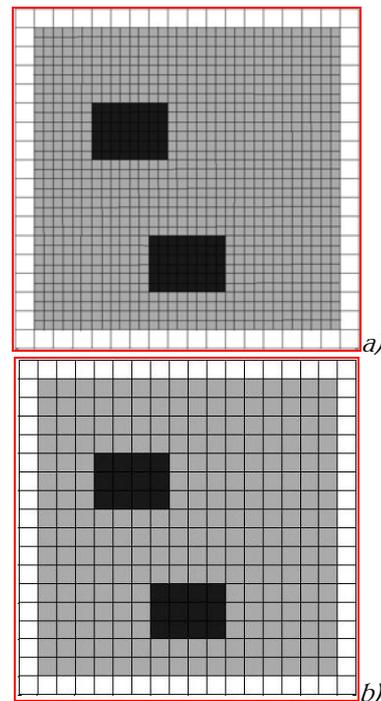


Figure 2. Meshes used to overcome the inverse crime (a). Mesh used in forward problem (b). Mesh used in inverse problem

In case of forward problem, the rectangular model is divided into 1024 square cells of dimension 0.3cm X 0.3cm and the saline water region is divided into 32 cells of dimension 0.6cm X 0.6cm. During the inverse problem, the rectangular model together with saline water region is divided into 324 equal square cells 0.6 cm \times 0.6 cm. The measurement set contains 288 independent data [3].

During the iterative reconstruction, the complex permittivity values of the cells filled up with saline water were assumed to be known, thus rendering the problem of estimating the complex dielectric constants of the remaining 256 cells.

RESULTS AND DISCUSSIONS

To apply the reconstruction algorithm, it was initially assumed that the biological medium is filled up with muscle only. The received fields at different receiver locations were computed for each transmitter position.

In our earlier works, the regularizing parameter was monotonically decreasing by a factor of 10. In this paper when the same decrement factor is used, the reconstructed model was not satisfactory as shown in the figure 3. Instead, when the decrement factor is chosen as 2, the reconstructed model is quite acceptable. So, the decrement factor for the regularizing parameter is chosen as 2 here.

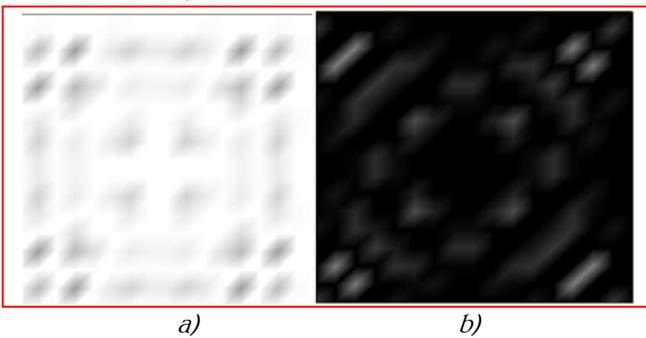


Figure 3. Reconstructed model with $\lambda = 10$ (a). Real part (b). Imaginary part

As usual, the only priori information we have used in our algorithm is that the real part of the complex dielectric constant cannot be negative and the imaginary part cannot be positive. Figure 4 (a) and Figure 4(b) shows the real part and imaginary part of the reconstructed model with our present algorithm with $\lambda = 2$.

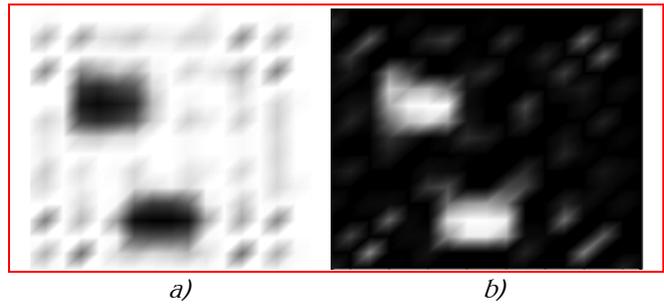


Figure 4. Reconstructed model with $\lambda = 02$ (a) Real part (b) Imaginary part

After applying the different image Arithmetic filters and image enhancement filters to the above reconstructed model, the quality of the reconstructed model have been improved in terms of noise as shown in the Figure 5, Figure 6 and Figure 7.

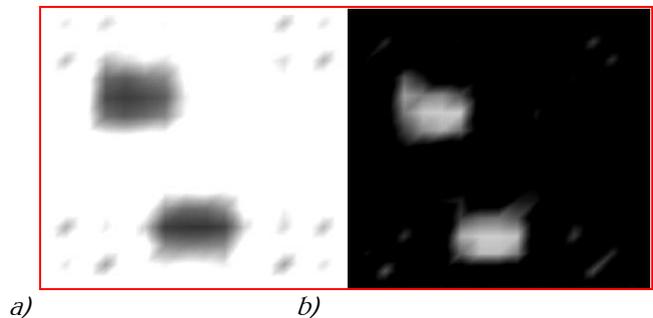


Figure 5. Reconstructed model after the image arithmetic filter being used (using image addition/subtraction technique) (a) Real part (b) Imaginary part

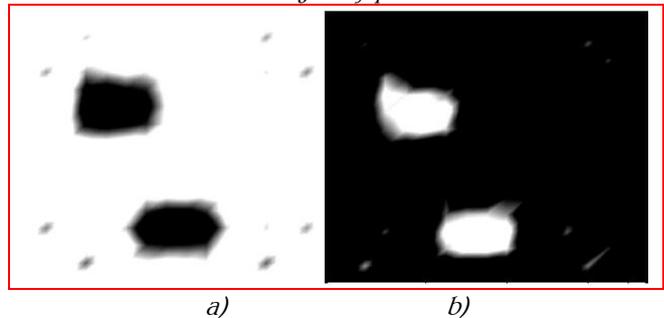


Figure 6. Reconstructed model after the image enhancement filter being used (using image adjustment technique) (a) Real part (b) Imaginary part

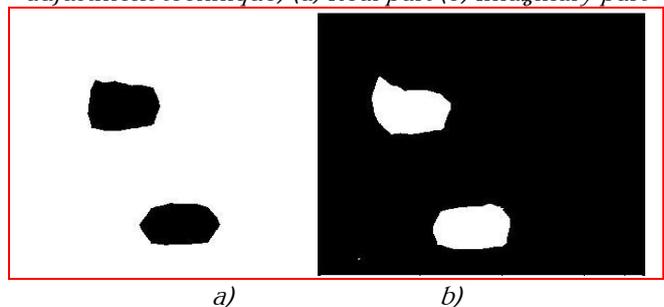


Figure 7. Reconstructed model after the image enhancement filter being used (using histogram equalization technique). (a) Real part (b) Imaginary part

The clarity of an image can be highly improved through different image enhancement techniques. Reducing the noise, deblurring the image and/or increasing the contrast can enhance the quality of an image in terms of human viewing. Among the several image enhancement techniques, the image addition/subtraction technique, the image adjustment technique and the histogram equalization technique produced the desired enhanced output in our present problem.

In case of image addition or subtraction technique, the algorithm basically adds or subtracts two images, or add/subtract a constant to image defined by the programmer.

In case of image adjustment technique, the algorithm maps the image intensity values to new intensity values specified by the programmer. This increases the contrast of the output image.

In case of histogram equalization technique, the algorithm enhances the contrast of images by mapping the intensity values of an image, so that the histogram of the output image matches a specified histogram.

Thus applying different image enhancement techniques to our reconstructed model, the clarity of the image has been improved significantly.

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DEFECTS IN THE LIBYAN CONSTRUCTION INDUSTRY: A CASE STUDY OF BANI WALID CITY

■ Abstract:

Defects in newly completed buildings are fast becoming serious phenomena as more low cost and medium cost houses are being built. One of the many approaches that have been utilized to alleviate defects is the introduction of the zero defects concept in construction. This research is undertaken to find out the level of awareness and perception of construction industry players about this concept, and whether zero defects or an aim towards achieving zero defects is attainable. A review of the relevant literature on the subject of defects and the zero defects concepts was executed, followed by a field research in the form of a questionnaire. The scope of this paper encompasses a study of defects in construction industry, and the concept and its application in the local construction scene in Libya. This paper has managed to ascertain that despite the unenthusiastic responses from members in the industry towards this concept in general, most industry players are optimistic that defects can be reduced if certain constructive measures are taken. In summary, the findings of this paper are suggested that absolute zero defects may not be attainable, in concurrence with the literature review earlier. However, if proactive steps are taken, the quest towards achieving zero defects can be obtained.

■ Keywords:

zero defects, construction industry, awareness and perception, Libya

■ INTRODUCTION

The construction industry all around the world is getting modern, advance and growing day by day with the help of information technology age. Libya has a very big covered land and accordingly the requirement of the people is to develop big and better facility in the houses as well as in the housing society. One of the competition which government is facing is people want to pay more to buy better quality houses for the better living. To build an affordable and good quality housing schemes government has to use the strategic planning to over come this issue. Another important aspect

of the construction industry is the residential part, the planning and the development of residential properties which hold special interest for estate management surveyors. Building designers' decisions affect long term quality a life cycle cost of buildings; the three most important design-related failure causes were weather impact, impacts from occupants and loads as well as moistures from the wet areas. Insufficient considerations for these failures causes were found to be the key in preventing these defects. The design strategies that could successfully prevent triggering these defects include aligning material performance against adverse weather conditions, preventing impact from occupants

and loads, preventing water leakage, improving specifications and improving design clarity, details, and layout. The Oxford Dictionary of Current English (1984) defines defects as 'lack of something essential, imperfection, shortcoming, failing. A defect is defined in ISO 8402 as the non-fulfillment of intended usage requirements. It means lacking and not meeting the required standard. A defect is present when there is a difference the required standard and the actual delivered standard. The concept of Zero defects are performance to agreed specification (Eaton, 1996; Al-Mahade et al., 2008). It literally means 100% error free. Is it attainable, or is it good enough to achieve a certain percentage of acceptable defects? The zero defects concept became popular when Crosby a quality manager developed a concept based on his beliefs that product should be defect-free when delivered to the customer (Harrington, 1998). This concept was neither a technique nor a methodology; it embodied an attitude that Crosby sought to instill in every individual. It focused on an individual's commitment to always meet the engineering specification. Defects may appear as a building is constructed or after an element of work is completed. In most standard forms of buildings contractors, there are usually provisions that require rectification of defects by the contractor at his own costs. The defects Liability Period (DLP) is a period of a number of months s stated in the contract, commencing from the day a project is certified practically completed and handed over to the client (Sikan, 2001). Defects in construction can result in very large costs. Even with minor defects; the operations of a quality may be impaired, resulting in increased costs and delays. Generally construction industry players believe that to achieve zero defects in construction is not possible. However it must be highlighted that the concept of zero defects in not only about achieving zero effects as an absolute goal, but also generating a different attitude towards work. It is about looking at projects from a customer's point of view and catering for their needs. It is about getting the work right the first time and delivering the project on time (Costain, 1998). Application of the zero defects concept in construction is relatively new, especially in Libya. It is a subject of discussion in many forums and researchers overseas and is being implemented to a certain extent in other parts of

the world, especially in western countries and some Asian countries like Malaysia and Singapore. However, defects occur either because of poor design or low quality workmanship or because the building was not constructed according to the design or because it has been subjected to factors not followed for in the design. These causes may operate singly or in combination and result in defects indicated by changes in composition of materials in the construction itself; in the size, shape or weight of materials or parts of a building; or simply in appearance. One of the many approaches that have been devised to reduce this problem of defects in newly completed buildings is the introduction of the zero defects concept. This concept, which is generally synonymous with the manufacturing industry has become the subject of discussions in many forums, and has recorded laudable results in selected demonstration projects overseas. Therefore, the objective of this study is to identify the level of awareness of local industry players towards zero defects in Libyan construction, to find out the perception of local industry players towards zero defects. To study on the perception of local industry players in achieving zero. This study is exploratory and analytical in nature. The purpose is purely to provide some conclusive evidence on the construction defects in Libya.

■ RESEARCH PROBLEM

There are huge amount of standards and codes available internationally. However, each is designed specifically to overcome regional problems. There are some common problems from construction defects in homes and condominiums. As home buyer, it is the best interest to at least be aware of the potential construction defects that can occur in a home or a condominium (Steven, 2005). There are some common construction defect lists Al-Mahade et al., 2008. However, the following are descriptions of some common problems arising from some constructions defects in homes and condominiums in Libya (GPC, 2006; Al-Mahade et al., 2008): (i) Construction defects could be the result of improper design or installation deficiencies; and (ii) Construction defects could be due to substandard construction strategies, faulty workmanship inside and outside house,

bad building materials, poor drainage systems or improper soil analysis and preparation.

RESEARCH METHODOLOGY

All the data and information was collected from basically two sources. The first data sources are from published book, articles and journals, and internet websites. Secondly, primary data to be analyzed was collected from field researches, which are through questionnaires. The questionnaires were administrated over a period of two (20 weeks and another two (2) weeks were used to collect and key in the data. This questionnaire was distributed to 40 respondents, consisting of client's developers, consultants and contractors. The questionnaires were delivered personally, sent out by fax and e-mailed to the respondents. From 40 questionnaires distributed, 32 (80%) returned with completed answers. Data was coded and transferred to the computer and analyzed using the Statistical Package for Social Sciences (SPSS). The testing methods used were Descriptive statistics.

RESULTS ANALYSIS

From the responses gathered, it can be clearly figured out that the majority of respondents agreed that the local construction industry is plagued with defective works, especially in low cost and medium cost houses. Seventy nine percent had answered 'yes' whilst only the remaining 21% answered in the negative. This corresponds with the increasing number of complaints received by the Ministry of Housing and Local Government for the past several years. When questioned about what are the most common defects often encountered in newly completed building? It revealed from that the most defects are cracks (70.7%) followed by defects related to structural defects (14.6%) while defects related to water intrusion/damp and other defects were least selected (Table 1). However, cracks in building may appear in many forms. Most cracks such as hairline cracks are not dangerous the appearance of a building. However, there are wide gaping cracks which are not only eyesores, but also pose a danger to inhabitants. Thirty one and seven percent from the respondents selected poor workmanship as the major cause of defects (Table 2). All the

respondents grouping also indicated a large majority for poor workmanship.

Table 1. Illustrate the most common defects in completed building in Libya

Type of defers	Percentages
Cracks	29 (70.7%)
Defect related to water intrusion / damp	4 (9.8%)
Detachment	2(4.9%)
Structural defects	6 (14.6%)

Table 2. What are the common causes often encountered

Type of causes	Percentages
Poor workmanship	13 (31.7%)
Poor supervision	19 (46.3%)
Inappropriate design / selection of materials	7 (17.1%)
Substandard materials	2 (4.9%)

The responded were also asked about their satisfaction with the overall quality of completed buildings by their organization. However, the majority (43.8%) stated they were sometimes satisfied while the remaining 34.4% were satisfied yes (Table 3).

Table 3. Overall quality of completed buildings by the organizations in Libya

Type of causes	Percentages and Frequencies
Yes	11 (26.8%)
Sometimes	18 (43.9%)
Most of the time	11 (26.8%)
Never	1 (2.4%)

When asked whether the implementation of quality programmes can help to reduce defects in construction end products, 84.4% had answered 'yes', whilst only the remaining 15.6% answered in the negative. However, as results, it is clearly observed that a huge number of the respondents gave positive answers. Awareness about the zero defects concept in construction is not relatively high because 44 % had answered 'yes', whilst only the remaining 56% answered negatively. When questioned "are you aware of the zero defects house construction programme launched by the Ministry of Housing and Local Government. The results of the survey showed that the awareness of the clients. 54% had answered, 'Yes', whilst only the remaining 46 % answered in the negative. On the other hand, when we questioned " Are you aware of the construction industry standard. Fifty six percent of the respondents were aware of these systems from their responses to the above mentioned question. The respondents 80% surveyed

believed that the Ministry of Housing and Local Government is not doing enough to increase the awareness of industry players to reduce defects in newly completed building. This strengthens the point that more need to be done on the part of the authorities to assist industry players in producing better quality building with fewer defects. A majority of the respondents (80%) have believed that quality programme can be implemented effectively in the local construction industry which respondents a rather optimistic view. Therefore to ensure effective implementation, certain aspects which are unique to the construction industry must be addressed. To improve the quality in construction end products and eventually promote a zero defects culture in the industry. An overall large majority of 34.1% of respondents pointed towards that training and implementation as the most important factors followed by awareness programmes (Table 4).

Table 4. Contributing towards reducing defects, and eventually promote a zero defects culture

Type of causes	Percentages and Frequencies
Awareness	10 (24.4%)
Training	14 (34.1%)
Implementation	14 (34.1%)
Alternative	3 (7.5%)

Selection training programmes for both local and foreign workers as the next contributor is very much related to the common causes of defects where, poor workmanship had been chosen as the most common cause of defects in building. Thus, proper and effective training programmes as well as stricter enforcement must be devised by the relevant authorities to ensure only qualified or skilled workman are followed on sites.

CONCLUSION AND RECOMMENDATION

Defects in buildings are numerous and varied, either in the local construction scenario, or in other parts of the world. The problem of the considerable extent of defects present in our newly completed buildings must be overcome as it severely affects the construction industry. It has been accomplished through this paper that many industry players agreed with the assumption that the local construction industry is plagued with defective works. If the present situation persists, the local industry will not be

able to complete either locally or internationally, given the current trend towards globalization. Therefore, this problem must be given due consideration and not to be taken lightly by all the parties involved. The role of authorities such as MHLG was also found to be lacking. More programmes to increase awareness of the people involved in the industry should be carried out. The result of this paper indicated that a fair majority of industry players believe that, while 100% defect free, or zero defects is not free attainable, the setting of a goal towards zero defects is achievable. Stricter enforcement must also be employed in implementing quality programmes.

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THE CITY DEVELOPMENT EFFECT ON WORK BURDEN OF WOMEN POOR IN JAKARTA

■ **Abstract:**

Development is done on the ecosystem of Jakarta generate increased economic growth with enough significant of years. However, economic growth cannot be enjoyed by the whole community of Jakarta. Urban development not only generates economic growth and environmental degradation, such as air pollution, pollution of river water and ground water. Both of these constitute a social gap for the city of Jakarta. Where these gaps become a heavy burden for the poor city of Jakarta. Heaviness of the same was not felt by the poor men and poor women of Jakarta. Women, who have experienced poverty in the city of Jakarta, received a heavier burden than men. These burdens perceived internally and externally. Internal burden is the burden that is felt in the lives of female domestic shutter and external load is felt in the public shutter poor women. This burden is also due to women living in poverty will try to keep life in many ways. Poor women must work to maintain family life and her husband, though the choice is very limited work. Poor women are important actors in sustainable urban development through make community sustain. As a result of job choices, poor women are behind the effect and become input (input) for the balance of the ecosystem of Jakarta. If the input quality of the ecosystem conditions will lead to a balanced process that ultimately sustainable. This sustainability will be transmitted to the sustainability of ecosystems nationally, regionally and globally.

■ **Keywords:**

city development, work burden, double burden, women poor

■ **INTRODUCTION**

Current development, an essential element of building the physical and spiritual human being and change the fate of mankind to be able to get out of the trap of poverty and underdevelopment (Soetarjono Salim in 1985). Thus, development is a process in the state of a system (Teune 1988:39). Where, in this process, the development not only related to a system of economic and social development, but also related to environmental protection system is the responsibility of the entire world community.

In fact, development is the result of the interaction of social and economic subsystems, subsystem-made environment and natural subsystems in an urban ecosystem, gave to the ambiguous condition in a society. On the one hand, development of city as a pride of the community because it produces economic growth. While, it is the burden of life for certain groups, namely: urban poor. This fact is happening in the community of Jakarta. Another reality, that the development of Jakarta was still unable to eliminate poverty in the urban community. Instead, today, a loss of quality of

life of poor communities at Jakarta was happening. This is shown through a residential land eviction of the poor in order ordering the city of Jakarta. RUTRW Jakarta in 2010, allocated land for settlements covering 37.21% of the area of the city or 25,477,68 ha.

Whereas in 2001, large settlements in the city of Jakarta is about 43,475,09 ha (Jakarta dalam angka 2001), it has been a reduction in land settlement. If assumed that evicted the density settlements with 300 people per hectare (the slums), then that must be evicted is 5.4 million inhabitants of urban poor. This means structuring the city instead displacing of the urban poor, and then eventually the urban poor will get poorer.

This is supported by data obtained INFID (2005) that the eviction efforts have been made poor DKI Jakarta government during the year 2001-2003. From the data the United Nations (1997) argued that the poverty situation of the most wonderful place in developing countries, where there are 1.3 billion people around the world who are poor, 70% of whom are women. This condition also supported by data that suggested the ILO (2004), that there are 550 million working poor in the world, or people who are unable to lift themselves and their family income above U.S. \$ 1 per day, and approximately 330 million, or 60 percent are women. Poverty has led to women bear a heavier burden than men. In addition to providing 66% of her working hours, poor women obtain only 10% of their work (Tjokrowinoto 1996). Working hours of women around 30-50 per cent longer than men the same age and to work paid or unpaid, compared with men the same age (Cahyono 2005).

It turned out that poverty cannot be separated merely because the burden of injustice for women's economic shortcomings. But there is also oppression, deprivation of rights, which gave birth to sorrow, grief, and deep wounds. Studies of the ILO-IPEC conducted in 2003 estimated the number of commercial sex workers under 18 years of approximately 1244 children in Jakarta (TEMPO Interaktif 12 Juni 2003). Found that one of six women experiencing abuse, and violence, is more pronounced in poor countries (Voice Reform, December 2, 2005).

The aim of this research is to discover and understand the poverty living conditions of women poor in the Jakarta city, where poor women has a heavier burden of poverty than men due to urban development and are unable to get out of these poor living conditions.

Development is to build a human. Therefore, human became a major factor, both as subject and object, because humans are basically the main of ecological factor (Soetaryono 1985:101). In the developing countries, development not only increase the national income, not merely increase the production of goods and services, but the essential element of development, namely to build physical and spiritual human being and change the fate of mankind to be able to get out of the trap poverty and underdevelopment (Soetarjono Salim in 1985). The result of development adding some dynamics and change together (Teune 1988:39-40). The development is a process that involves multiple dimensional major changes in social structures, attitudes, and national institutions, such as: accelerating economic growth, inequality reduction, and eradication of absolute poverty (Todaro 1994), specifically development have mean multidimensional (Keats 2004). However, most of the development dimension is implemented as an increase in people's lifestyles by improving education, income, skills development and employment (Keats 2004). According to the understanding of the unitary state of Indonesia Republic is set forth in RI Act No. 25 of 2004 concerning National Development Planning System, the National Development organized based on democracy with the principles of togetherness, equitable, sustainable, environment, and balancing independence with the progress and national unity.

Essentially, urban development is the result of the interaction process that occurs continuously between the system of economic development, educational development system, health system development, manpower development system and subsystem of the natural environment in urban ecosystems. The results of the interaction process significantly affect the poverty conditions of women in Jakarta.

The pattern work of patriarchy put women as mothers, women who keep house and the kids without the help of men, women risk losing its own economic resources and become one of the

factors that increase the "feminization of poverty" in which women typically get wages/income lower than men. Family is one part of the various subsystems within the community and in the community subsystem will not escape from its interactions with other sub-systems that exist in society. (Megawangi 1999:66). According Megawangi, each family (nuclear family), has duties as a social system, i.e.: tasks, achieving goals, integration and solidarity, as well as patterns of continuity or maintenance of the family.

Is one of the major contributions of feminist theory that the sexual division of roles and subordinated women by men are two things that have relevance (Agger 2008:207). In Agger note, the sexual division of labor has helped explain how the subordination of women in the labor market, politics, and culture reflects and reinforces women's subordination in the household. That due to the division of labor based on sex has created the objectivity of women by men. Where is the object for men in the family, which acts both as a spouse or sexual partner helpers, objectifications women in the public domain.

Sexual division of labor is different in each community (Widanti 2005:410). There is a writing that, a harmonious society is not layered and women have high authority in subsistence societies. But there are also illustrates that in a society, whereas the position of women toward slaves. However, according to Widanti records that the general pattern division of labor, as follows:

- ✚ In hunting societies: women gathering food and small animals, while men hunted.
- ✚ Pre capitalist society: women's subordinated of the dominant classes, but in a nuclear, family in which the product and use value is made, women continue to retain authority.
- ✚ In a capitalist society: especially, in the third world, at the beginning of industrialization, where many industrial absorb labor and entering women from the domestic sector, in drag to the industrial sector.

The types of work they do that has been socialized domestic in the family such as sewing, serving, cooking, and others. After industrialized capital intensive, then more men were recruited in the factory. However, for the purpose of export industry, female workers are not replaced by machines or male workers, so that

women workers with low wages, work light and do not develop. Often, have not dignified treatment by employers or male workers. Gender inequities resulting inferiority female workers, and thus patriarchy as a social system to join with the capitalism as economic system. According to Agger (2008), the division of labor of men and women actually based on ideology patriarchy or male supremacy in the domestic and public area . Chodorow cited Agger (2008), considers the family as a place where combat sexual division of labor and expense of women weaken and reproduce strictly the separation of gender roles between men and women. The sexual division of labor in the household and the world of empirical shows that the differentiation of gender roles in families establish a pattern of gender inequality in the world of work (Agger 2008).

Pattern of labor division in pre-capitalist society to a capitalist, which marginalizes the essential interests of women as human beings, till now still preserved. Pattern preservation of labor division and gender bias against women both in the realm of domestic/private and the public sphere, the result of parenting parents from generation to generation (Widanti 2005:181). This is a defined social roles, in which the status and role is the recognition given by the society for us, regardless of the individuals quality and our efforts what we strive through our efforts alone (Young & Mack in Horton & Hunt 1984:121). As a result of a determined social roles, according to Clementine Dehwe in her essay "Double Burden" of published by www.ufa.se, that every woman in the world has a lot of work. Until now, women's work will never be finished, and significantly, when more women working than working time of men.

Double burden by implication drawn from www.psychology.wikia.com, is one of describe daily life in Western Europe and the USA which refers to the work burden of women and men for money (wages), but also has the responsibility for household work related to people who are not paid (not paid).

The dichotomy of private (domestic) and public, females and males is the result of modern history (Ross Pole in Widanti 2005), Where, with the emergence of capitalism, the social product distribution is determined by the workings of the market and not by tradition, status or family obligations. Thus, the concept of work is defined

as wage work outside the family and in the factory. Also according to Pole, dichotomy of productive work (wage) and reproductive work (not wage). In fact, the house does not necessarily work to reproductive work and work outside the home into productive work (Widanti 2005). With example, such as PKK jobs and employment of women workers who cook food to eat and foods to be sold at the factory. According to Oakley, quoted by Ollenburger & Moore (2002:119), domestic work dominated of women takes the high time, is about 30-60 hours per week and not paid (to 99 hours per week if included parenting time). In which married couples, wife majority use a lot of time in housework, which is about 70% (Walker & Woods in Ollenburger & Moore 2002).

Family labor, which also includes the urban poor, exacerbated by lack of money, poor daily protection, lack of economy, and lack of autonomy at work hired, they pair must match each other duties of (Hochschild in Ollenburger & Moore 2002). Here, that the double burden of women is more severe than in men caused by the women labeling as domestic creatures (Widanti 2005:217). Where, on the family life of workers, women not only worked in the domestic realm, but also are required to work in the public domain, because the income is not enough. This opinion is supported also by Hochschild (Ollenburger & Moore 2002:121), that women should work to get the wages for male partner was not enough to finance his family's life.

As a result of the division of labor based on gender, women are required to perform domestic chores / household (such as: washing dishes, laundry, babysitting, cleaning the house). Meanwhile, men are required to make a living for the family (public duties). This task will be tough going on the urban poor who have toward to sustain life in the city. Poor women not only have a compulsory duty in the domestic realm, but also they have to work in the public domain. It is also suggested by Mead (1957) in Sajogjo (1983) that the burden is still on families, because for all the work must be done alone. According to the Sari report (2004) that, for any full-time work (between 35-74 hours / week) is more widely accepted by men (71.6%) than women (48%), and the majority of workers who work with the long hours (over 75 hours / week) was also female (44%).

The high number of women who work in long hours to prove that women must work overtime to cover / compensate for low wages she receives. In the meantime, the small number of full time women worker is the result of necessity to do household work at the same time. In the UNFPA data (2002) cited in Kesrepro Dot Info (2003) that women in some countries to work with working hours longer than men and probably half of the total women working time who used an unpaid job. To see double burden conditions of women poor, captured data on the number of women poor who worked more than 40 hours in one week. Typically workers who work more than 40 hours of work is labor as factory workers. if, assumed that working hours based on data from the UNFPA (2002) that women in some countries to work with working hours longer than men and probably half of the total working time of women who used an unpaid job.

Thus, it is assumed that women working in the public s and the domestic sphere. Jobs in the public sphere are paid, while employment in the domestic realm is not paid. Instead of men, in the domestic realm with women, i.e. paid employment, but not burdened domestic work, so there is no unpaid work for men. In the family, husband and wife worked, then the wife who worked in the public sphere, should work well in the domestic realm to serve her husband and children. The job was never assessed or paid, because it was already part of the work of women and not men's work

METHODS

The research is qualitative research with participatory observation approach. Setting the assumption that all poor women of Jakarta Urban area, has the same chance in life due to the burden of Jakarta city development. Define the poor women who become targets based on the following characteristics:

- a. As a wage earner, mostly poor women threw themselves on sectors such as marginal, as factory workers, laundry workers, domestic servants, small traders (Westy 2008).
- b. Including vulnerable groups experiencing domestic violence, whether it be physical, psychological, sexual, social, and negligence of household (based on survey results in

Regency Bandung by SAPA quoted in the Westy in 2008).

- c. *Has a weight of work burden (burden), which must be borne in work productive the outside home, because she still had to carry out productive activities in the house, like washing, cooking, and parenting and child care (official Setia MS 2003).*
- d. *Dependent on micro businesses, and power relations that suppress women's groups, in which "power press" not just come from the man or the domestic space, but the greatest emphasis instead come from the market structure (Dewayanti 2003).*
- e. *Working at jobs that do not require skills and capital, as street vendors, and on this street trade, women occupy the poorest places (Murray 1995:53).*
- f. *Do not have time to attend meetings of sewing classes, cooking is formed by the village government (Murray 1995:94).*
- g. *Working without an employment contract, are required to work on holidays, was fired when pregnant (Murray 1995:118).*
- h. *For young women (single), more like work than on money. With hope of a rich man who will marry him and make him rich (Murray 1995:119).*
- i. *Choosing a job as a lower-class prostitutes and working in the bars of Jakarta who did not cover charge, the places in the hotel, the disco and bars area at the time of "ladies night" or working on a more formal conditions anymore, namely as a bar waiter (Murray 1995:125).*

Based on the characteristics of poor women, the chosen four categories, namely: women who work as domestic servants, women who worked as a waitress in a bar, women who work as street vendors and women sex workers. Observations made during 7 months (January-September 2007) by using the observation participatory method

■ RESULTS AND DISCUSSION

■ The Double Burden of Women as Domestic Servant

The Yaya main job other than as a housewife (domestic sphere), as well as providers, as domestic servants (DS). DS is a man who worked at a paid domestic realm. According to consumer theory, that the services, including

resources that can be marketed in the labor market. However, the fact that housework is naturally identified with the women work, is a form of division of labor based on gender (socially constructed) where the man is positioned to do paid work and women doing unpaid work. Jobs categorized as domestic workers in the informal sector jobs, the protection they are outside the context of labor laws. They are task considered natural women and the community's view that the housework is a job without professional skills. Yaya worked as a housekeeper at the rooming house "GC", while her husband worked as a "motorcycle taxi", based in locations around the area where Yaya family lived (around the area Cikini market of Central Jakarta). Make a living and have dependents, the two main reasons that make Yaya work as domestic servant. Yaya's husband without a job since the layoffs in 2001.

The use of working time (domestic realm and the public sphere) and the rest Yaya and her husband, as described in Table 76 and Table 77 below. Double burden may be interpreted as a work burden of women and men for money (wages), but also has the responsibility for household work related to people who are not paid (not paid). The double burden phenomenon, tend to only be seen from the "wage system" course. Tend also the families who are able (rich), in which women not to work in the public sphere, but it only works in the domestic sphere. In the lives of urban poor families in the Jakarta city, women are forced to take part in the work in the public sphere. So the double burden is not only limited to the wage system alone. The results of the research analysis of urban poor families in Jakarta, obtained phenomenon of double burden experienced by Yaya to work as domestic workers, because of two factors, namely:

Internal Factors. *Internal factor caused by division of labor is measured in the use of Yaya and husband work time (domestic and public). Where Yaya more often used than the husband's working time. And both worked in the informal sector (irregular income).*

External factors. *While external factors by work activities in the public sphere, such as: wage system, working mechanism, and the risk of employment. Wage system that is incompatible with UMP DKI Jakarta and the lack of health benefits, vacation and holidays. Also, working*

mechanism, in which working hours and forms of Yaya work. And the risk of household work, who not tend to use safety equipment themselves (such as masks and gloves). Risk of loss wages, because employers who are also GC residents are "runaway/escape" due to avoid paying boarders. Yaya did not have time to spare, for himself and for his family. Thus, she vulnerable to stress and depression due to fatigue. According to specialist doctors in the U.S. women's Jessica Anderson quoted in <http://indonesian.irib.ir>, that one other factor in the cause of depression in women is stress and pressure experienced in the outdoors, where the lack of balance between the duties of wife and housewives on one side and work on the other side. This condition is according to Anderson, creating a is very bad atmosphere and magnifies the stress experienced by women. Anderson also noted that when women are required to work outside the home just like men, they will suffer from depression more quickly since they are very sensitive in dealing with all things. Both of these factors simultaneously affect the life of Yaya, who then these factors into a work burden Yaya each day (Fig. 1).

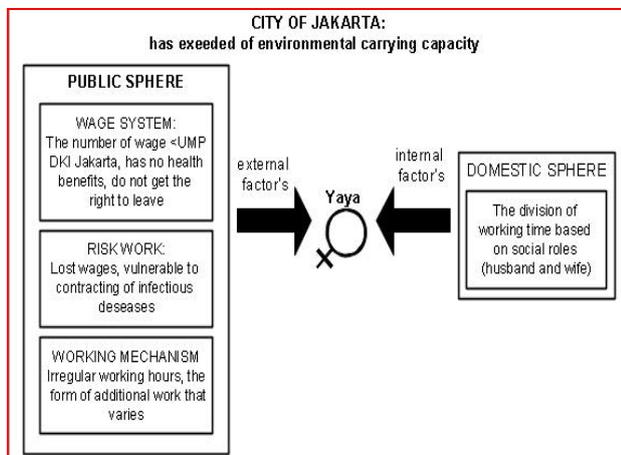


Figure 1. The phenomenon of Yaya Double Burden

■ **The Double Burden of Women as a Waitress (hostess)**

Tika, besides as housewife, Tika also worked as a waitress in "EM" pubs & bars in Central Jakarta. Tika and her husband both worked in the public domain. They need the work, to feed the children and the father and mother's her husband. From the time employed Tika and her husband, obtained within 1 day that she using work time in the domestic realm as much as 12 hours or 84 hours per week. She husband while

using only 35 hours a week to work in the domestic realm. From the observations made, the phenomenon of her double burden as follows:

Internal factors. Factor caused by the division of labor between the Tika and her husband measured from the time both domestic work and the public. Where she more often used than her husband's working hours, i.e. 55% and 45%. his happened, because it is still attached to the family of Indonesia that a woman should be doing homework, even though women are working as wage earners. These jobs, such as: cooking, laundry, take kids to school and help children learn.

External Factors. Factors caused by she work activities in the public sphere are "EM" pubs & bars. External factors are: wage system, working mechanism, and the risk of work. Wage system is done by "EM" pubs & bars, does not meet the standards of UMP DKI Jakarta, even the waitress (including Tika) tend not given wages. Remuneration by way of turnover system applied to Tika and the other women working the pubs & bars, while the officers of the manager who the men were not imposed such a wage system. And that became an important part in the pub & bar business is the waitress, but they who have the lowest wages in the business arena. Working mechanism, where the she must have "standby" to work at night until 21:00 this morning at 04.00. She must accompany and serve the guests, who became regular customers and new guests to the pub & bar. Way of working that do not distinguish between a man who wants to be served or accompanied by her, has made this woman as a servant who no longer have the dignity and self-esteem. This was done so her turnover reached. Result or the most important risk of this work, are: Her maternal health, both from infectious diseases, as well as his endurance, also risk being harassed by every man who came and received a negative stigma from surrounding communities as the women workers of the glittering night.

■ **The Double Burden of Women as a Street Vendors**

Ina and her husband worked as street hawkers (street vendors). Ina trading cigarettes, food and soft drinks. They trade in the end "halfway" line the sidewalks along Central Jakarta Wahid Hasim

using carts that are not moveable or permanent (Fig. 83). Ina and her husband have work burden and rest periods equal. Domestic and public activities for the family of Ina cannot be separated, because they have to take place simultaneously and at the same location, namely on the pavement (the road). From the above description, the phenomenon of Ina double burden, as follows:

Internal factors. The phenomenon is caused by factors from within the family, namely: the division of labor when the Ina and her husband. Both have the same time in the public domain. This is due to other work as street vendors conducted by Ina, and then her husband also joined together in the work. Of the total time, Ina's husband use work time more than her, which is 51% and 49%. But these percentages, sometimes changing, that is, between Ina and her husband happens a fair division of labor and mutually adjust to each other.

External Factors. Factors caused by work activities in the public domain. Forms of work as street vendors, external factors that make this phenomenon of double Burden, is mechanisms and risk work. Wage system, not a burden, because the street vendors is a form of self-help efforts. Air pollution is a burden for the whole family the Ina's family. Although the overall burden of the family, but because of the expressive role, Ina should be socially responsible to the entire family. Where due to air pollution in locations where they sell, will result in increased expenditures for costs of health care for this family. According Resosudarmo (1996) that air pollution is a waste of production activities that use "toxic." Toxic material here is defined as inputs, which are used in the production process, which pollute the air. For example, such as gasoline and diesel. Threshold level of high air pollution causes health problems in the community. For example, various disorders of the throat, asthma and high blood pressure. Health problems caused by high levels of air pollution costs to society. Rather, those who are affected by these health problems will be the cost of treatment. Health problems caused by high levels of air pollution will reduce the effectiveness of production activities. The threat of losing business due to evicted by the government of Jakarta, since they use the area's roads (DAMIJA), other external factors in the choice of Ina

jobs. Ina have not free time to mingle with the kids and her husband normally. They are more interested to work from the rest and share the joys and sorrows of the family. In addition to the free time, they do not have space for a family gathering, and space for personal activities (MCK). They are always together with other poor people who became a fellow street vendors.

■ The Double Burden of Women Sex Workers

Sex work is a phenomenon shift of the role female body's from private areas to public areas, which are considered by society as a shift in the role of the sacred female body to the various secular activities (Kadir 2007:148). Kadir meaning prostitute who meets the prerequisites included as an element work, because in it there are elements that are traded, namely sex. Where sex is considered private, is now moving into the public realm, and here there is a process of exchange. Exchange is a process that involves the transfer of something tangible or intangible, real or symbolic, between two or more social actors, in which this exchange has been accepted as a basis for marketing (Mowen & Minor, 2002a :14-15). Marketing, according to Wroe Alderson cited in Mowen & Minor (2002a: 14), is the exchange that occurs between groups that consume the group provides.

From the analysis of the three women sex workers, though different ways to practice, but has a work burden that relatively similar for these women, even without their knowing it. The double burden included internal and external factors. Work as sex workers is a job that involves the exchange of services and money. However, a social risks impoverishing even more poor women. Because not only impoverishes the material, but also impoverishes the self-esteem (one of the basic human needs).

Devaluated. That is, if they do not stop doing these jobs, they will continue to waste and will continue to be the only item of economic value and time. These women will continue devaluated. Based on the theory of devaluation, rather than the neglect citizenship of women but also in the context of being harassed and judged them low in the world of work, including household work and a variety of services and jobs in the area of wage labor (Agger Einstein in 2008: 202).

Alienated from her work. In accordance with the theory of alienation from work, then the phenomenon, the work as sex workers are no longer to develop but alienate people, either from yourself or for others. Where's the sign of alienation is the power of money, common prostitutes, and human procuress nations. Humans are no longer acting for the sake of something of value in itself or for other needs, but only insofar as his actions make money. Everything in terms of price.

Where the work should be a source of pride, should reflect the skills of workers, because the products work, but this does not happen. Even more the worker produces the work, the more she, her inner world, to be poor.

Dependence on others (the slaves of others).

Occupation is a social function of human execution, in which men will feel that when doing the work, which means the job is making people even more advanced. However, in contrast to work as sex workers. In addition to these impoverished women's work, also create a new system of slavery, through the "healer" as a provider of spells with the practice of magical science. Where are the women sex workers, each time they will buy "mantra-mantra/gunaguna" they have to pay between Rp. 300,000 - Rp. 550.000, for any man who will work with (used to). Similarly to buy implant (as a charm), they have to pay Rp. 300,000 - Rp. 600.000, and depending on the implant type, to witch.

Losing confidence. Prone to lose self-confidence and tend to feel inferior. According to the theory of self-esteem, that: when the price of self-humiliation, the desire affiliates (join with others) increases, and it will increasingly responsive to receiving the love of others (Elaine Dayakisni & Hudainah in 2001). Thus, these women will continue to be trapped in poverty and helplessness due to the job.

Be an agent of sexually transmitted diseases.

Since the work of sex workers, have the main elements to be transacted is: sex and money, in which sex is considered private, but then moved into public areas. Thus, the internal factors for female sex workers, is the disruption of the reproductive organs (sex) women. In fact, to bear children, women must have sex with men as a biological reproductive process.

As a result, making the reproductive organs as a marketing element, then this organ is allowed to be used publicly. This is an internal conflict occurs. Women do not realize that maintaining reproductive rights are not an obligation. Women's rights became annoyed when the reproductive organs become affected his health, diseases such as sexually transmitted infections (STIs).

Sexually transmitted diseases, such as: GO or gonorrhea, genital herpes, syphilis, the chicken's comb, hepatitis and HIV/AIDS. These diseases are only can be transmitted through sexual contact, which means that STIs disease can spread throughout the community who often do sexual transactions. These diseases can cause infertility, miscarriage, cervical cancer, damage to eyesight, brain and heart, easily infected with HIV, hepatitis B and eventually cause death (Jurnal Perempuan 53:35).

The situation of HIV/AIDS in Indonesia reported in the "Business Achievement of the MDGs in Indonesia," in March 2008, at the mention that since it was first discovered in 2007, the number of HIV sufferers continues to increase. Up to March 2007 almost 8988 cases of AIDS and 5640 HIV cases were reported. According to some experts, this number is only a small part of the overall existing patients.

Community groups most at risk for this disease are infected commercial sex workers and their clients. In addition, awareness and correct knowledge about HIV and AIDS also remains a major problem in Indonesia. More than a third of women and a fifth of men had never heard at all about HIV/AIDS. If this trend does not change, estimated at more than 1 million Indonesia people will be infected in 2010. External factors received from the public domain coupled with internal factors received from the domestic realm, in which both of these factors are given for the three women suffering sex workers, although often they do not realize it.

Because they really lack an understanding of the meaning of the rights and obligations as human beings who function as individuals and people who have a social function. Work burden (double Burden) on poor women sex workers different on poor women is not working sex.

■ CONCLUSIONS

It turned out that poor women (as well as self-employed workers) carry a heavier burden of poverty than poor men. From the analysis conducted, it was concluded that the phenomenon of women's work burden and the poor man is the sum of external and internal factor's.

The burden caused by external factors is influenced by the load wage system, the risk of employment and working mechanisms for poor women who become workers (for the housekeeper, pubs & bars workers) plus the internal load, i.e. the time the division of labor between husband and wife in one household.

While the burden caused by internal factors is the division of work time. The burden caused by external factors for women who work alone (self employment), is the risk of employment while working in the public sphere (such as street vendors), which has no land and a location for women to perform activities in public space activities. This burden coupled with the internal load, i.e. the division time of labor between husband and wife in one household.

Where both the burden heavily influenced by the ideology of patriarchy, which is done by men based on the interpretation of women by religious experts.

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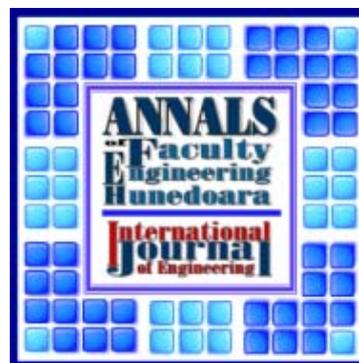
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THE CITY DEVELOPMENT EFFECT ON WORK BURDEN OF WOMEN POOR IN JAKARTA

■ **Abstract:**

In many cases, public open spaces in the cities have been designed and modified in very short-term goals, under the consideration of local situation. The style of public open space design has evolved in recent years to promote a more environmentally -friendly method of enjoying our outdoor property. As an enjoyable place in the cities, open space design should begin with an understanding of the future use of the property, and the proper design will be unique to a specific site and should be based on a careful review process. Objectives of the research is to develop a method of design review for outdoor space, by using Post Occupancy Evaluation (POE) method, which has been mostly applied in a single building or simple setting only. POE is a process of evaluation concerning the effectiveness of spatial design creation and its fixtures after the construction and operational function. The evaluation took place in some public open space in Manado which had most population in the cities. Research focused on 3 elements of space performances: technical, functional and behavioral aspects. The result shows that, technically, design performance of space could successfully bring pleasant for the visitor. Although its functions are very limited, the quality of environment is poor because of the thermal comfort and cleanliness problems.

■ **Keywords:**

public open space, design review, space performance

■ **INTRODUCTION**

Urbanization process in Manado city is significantly running fast over last two decades, but public open spaces provision for community activities is still served by the open space heritage as well as Sparta Tikala, Taman Kesatuan Bangsa, Sporting facilities in Sario and Klabat Stadium. As a waterfront city with 20 km long coastal lines, sloping landscape natural scenery and plenty of small rivers flow into the sea, Manado has great opportunity to develop outdoor space as public places at some strategic areas for providing the need of outdoor

activities . As an enjoyable place in the cities, open space design should begin with an understanding of the future use of the property, and the proper design will be unique to a specific site and should be based on a careful review process. In case of Manado, urban changed occurred significantly in very short term. Some international events were held in the city and in the coming years as a World Tourism City in 2010 revitalization of green infrastructures are presumed to be more activated. But the presences of public open spaces do not indicate significantly neither qualitative nor quantitative differences in

change. The government attentively focused on former open space available in the city like TKB, Sparta Tikala and seaside area. Meanwhile green infrastructure at the housing areas has just been the complementary objects, either in planning and provision or in management. Objective of the study is to conduct a design review of some public open space available as a framework in which to evaluate the accessibility and usability of each space for the public, in order to promote environmental quality. Preiser (1988) stated that space performance could be identified by 3 elements; they are technical, function and behavior aspects. Research tried to evaluate space performance of public open space in Manado, which emphasized on those 3 aspects. Technically, spatial design review focused on dimension of space in order to know adequacy ratio of space, sanitation and fixtures through environmental perception of the visitors. Functionally, evaluation was conducted by examine spatial usability and accessibility, and kinds of activities expected from users perspective. Behavioral aspects concern about observation of behavior setting occurs in sites, orientation ability, users' interaction with the whole elements available in place, and user's satisfactory in using the place.

METHODS

Space performance in architecture, indoor or outdoor, determined by several things. In case of outdoors, it could be designed by provision supporting elements like trees, sculpture, pond, or benches. All these elements should be well interpreted by individual senses. Exploration about human perception against space performance examines how far the combination elements enable to stimulate the positive feelings of human being. Method used in this research is development of Post Occupancy Evaluation (POE) whereas the application of POE is frequently used for evaluation the effectiveness of design interior in single buildings (Zimring C M, and Reizenstein J E, 1980). POE for outdoor facilities and other built environments could be ensured to promote physical environment more human and could improve urban environment quality of life in the future. POE is defined as a systematic process for evaluation of built environments from user's perspectives. It is used to identify ways to

improve quality of environment, to raise comfort and productivity of users, and to reduce design and maintenance cost. In this study, POE was conducted in 3 aspects of spatial performances: physics, functions and behavior to explore user-centered design guidelines for successful design of similar objects. Phases of POE to evaluate spatial performance are:

1. Observations of the place to identify who, where, when and, possibly, how users spend their time;
2. Survey determination and administration to users of the place for quantitative (statistical) measurement of the environment; (questionnaires)
3. Interviews of users regarding their experiences with the place; this helps to qualify where and how people spend their time in certain places or corners and not others;
4. Behavioral and Preference Mapping of the place, possibly at different scales, to delineate those areas that receive the most and least amount of use, as well as to quantify and qualify the reasons for the use;
5. Photographic analysis of how people use the space, as well as key measurements that demonstrate how people are either engaged or not connected to the environment.

Baker (1968) defined the basic unit for behavior mappings are behavior setting which are comprised of suitable combination between actions and its place/milieu. Meanwhile Ittelson marked, in general, behavior mappings follows 5 steps of procedures:

1. Basic sketch of setting area
2. Description and diagrams of behavior setting
3. Duration of observation.
4. Systematic procedures
5. Notation/coding

300 respondents from different age groups were participated in the research for answering the questionnaires, followed by interviews and observed behavior setting to explore the proper need of open space users. Three types of urban outdoor spaces in Manado were observed. First type is Urban Plaza in city central Taman Kesatuan Bangsa (TKB) and Sparta Tikala, Secondly is waterfront areas (Bahu Mall and Megamall seaside area, and Neighborhood open space in Ketang Baru and Bantik.

LOCATION OF RESEARCH OBJECTS

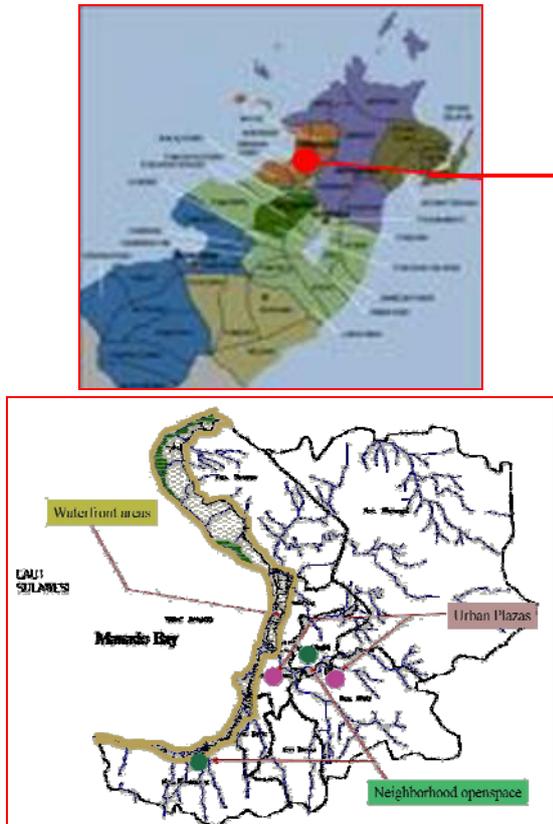


Figure.1. Map of Manado City

- RESULTS AND DISCUSSION
- SUMMARY DESCRIPTION
- URBAN PLAZA / CENTRAL SQUARE (TKB AND SPARTA TIKALA)

TKB is an old square plaza on the Central Business District area in Manado. Surrounded by commercial building, this square has historical background and become an important place because it has been designed since early period of urban growth. It has been removed (renewed) from times to times according to urban redevelopment process. During office hours, this square is intensively occupied by users for passing through from one side to another. Most of the visitors use the square as a pedestrian way to reach the local transportation. Some others used as a resting area to take a break after doing their shopping around the site. For the last few years, local authority has built an open theatre in the square for making this square more attractive. On the evening hours, the place become so quiet because all the stores adjacent were closed, and no activities surround. In 2007

local authority made a renovation on the TKB as a center of open air art and cultural performance for public leisure.



Figure 2: TKB and its surroundings, and Sparta Tikala Civic Square in Manado

Sparta Tikala is a formal open space, a civic space with lawn court and trees, created in front of local government official buildings. It has jogging track and benches insides. There are various decorative elements and functions on the site. People use the park for playing or doing some exercises, social gathering, ceremony, or other special events. Sometimes they use for exhibition and promotion affairs. During the day, this place is relatively quiet. On the north and south sides, outside the park, there are pedestrian ways with seats under big trees that formed comfortable space for shading. Although the park has lower density of usage, the existence of place gives particular impression for inhabitants.

Waterfront Areas

Another kind of open space in the city is coastal zones that exist along 20 km of Manado coastal lines. One of the most successful design for public open space is Bahu Mall recreation center. People of Manado enjoy much having meals in many occasions, particularly during recreation time. This social phenomenon leads the authority to provide many cafeterias in the recreation center like Bahu Mall and Mega Mas seaside area. Conception of the reclamation area

in coastal zones is multifunction area; consist of recreation, commercial and leisure. Morning hours, people do some exercises regularly, and during the day, commercial and cafeteria are predominant the whole area. Teenagers occupied some interesting spot area after school hours, talking with friends or playing. They enjoy the beautiful scenery of the sun goes down to the sea, and it is the best moment in the city. Sunday morning and holidays, the places are more crowded because some people from the region come to visit the area.



Figure 3: Bahu Mall and Mega Mall seaside area

Resemble Bahu Mall, Mega Mall area is relatively new development and still going under construction in some parts. The main activities in this area are commerce, sporting, public entertainment and baystreet cafe for enjoying beautiful scenery of sunset. Some parts of reclamation area (16%) belongs to the local government of Manado and proposed to be allocated for urban greenery system.

■ Community Open space

Two objects chosen as neighborhood open space in Manado are Ketang Baru field in Kampung Ternate and Bantik field in Malalayang district. At Ketang Baru, a community open space lies on the center of high density district in

Manado It plays important role for social gathering. It has only 3654 squaremeters wide. People use the field mainly for sporting facility particularly playing football. Sometimes they used for exhibition, social gathering and promotion affairs, or ceremony religious on the celebration day. There are pedestrian ways around; outside the short fences enclosed the field. Ketang Baru field has only one access from neighborhood street.



Figure 4: Ketang Baru and Bantik Field

At Malalayang districts, a small public open space 2378 m² lies on the north side of main corridor Trans Sulawesi. It is the only open space in the middle of housing settlement area in the south part of Manado. Covering by grass court, people use it for playing in the afternoon or just walking and passing through. Sometimes they use for special occasion like musical shows or cultural events. Maintenance of this space is managed by local authority; they create some decorative garden as a borderline with Trans Sulawesi. This kind of community open space served more than 50 000 habitants in the neighborhood.

■ OBSERVATION APPRAISAL OF PARTICIPANTS

Urban Community in Manado generally uses the open space available for leisure and entertainment or doing some exercises in the morning. For particular groups, especially

teenagers, the need of public space is important for social activities or special occasion like playing games and friendship gathering. For new couple, the existence of public open space is necessary for doing some sport or playing with children and other family. Obviously, the importance of open space is to refresh urban air quality, however it has to be taking into account its social aspect for accommodate the needs of expression and education for urban community.

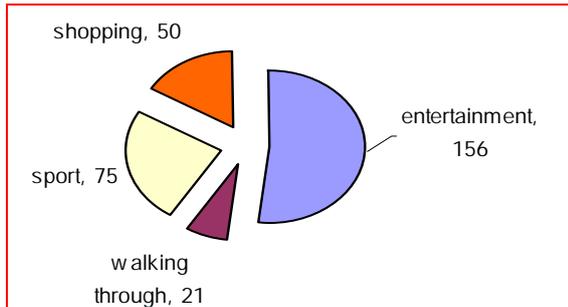


Figure 5: People come to public open space in Manado for discovering and entertainment

Most of the respondents stated that they enjoyed much the ambience of urban air quality, and they felt inconvenient being in the objects because of heats of microclimate and the rubbish. Although there are some trees for shading, they do not function well to reduce temperature. Local authority has provided some trash containers in each corner, but trash and wastepaper are scattered around.

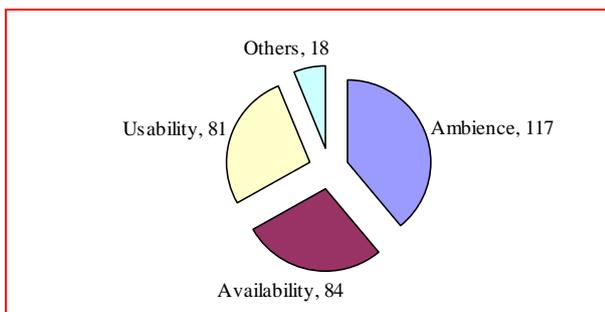


Figure 6: Personal interest being on public open space in Manado

Urban Plaza / central square (TKB and Sparta Tikala)

Urban plaza is an urban form that draws people together for passive enjoyment. (Jackson JB, 1985). Lynch K (1981) suggested that the plaza is intended as an activity focus, at the heart of some intensive urban area. Typically, it will be paved enclosed by high density structures and surrounded by streets, or in contact with them.

Observation of two plazas indicates that the most intensively area used are seating and stage performance available on the sites. On TKB, linear seating was occupied in the afternoon hours. There are not enough plants or canopy for shading that makes the place become very hot during the day. Children under 12 years old likes to play on the stage in groups after school. The density of fixtures stays inattentively in TKB and space is very limited and narrow. Since 2007, local government has eliminated the small café and food vendors. Fences are demolished, substituted by change of level around the edges. Replacement of theatre has totally change orientation of the space. Although two fountains were added in the square, that could not help to reduce temperature of microclimate during the day. Meanwhile, at Sparta Tikala, some attractive focal elements like statues and decorative plants bring special interest which encourages people to stop by, stay a little longer for enjoying the atmosphere. Although these two plazas were provided by some trash containers, the place was littering by food wrappers and soft drink cans in the open areas.

Table 1: Existing Condition of urban plazas

Situation	TKB (1)	TIKALA (2)
Spatial Shapes	Square 74 x 33 m	Trapezium 105 x 93 m
Access	2 entrance gates on east and west sides	Main entrance at the east and west sides.
Border lines	Fences and trottoir around and shopping arena in north and Westside	Streets around with high traffic density
Dimension of space	2442 m ²	9765 m ²
Materials used	concrete floor with decorative garden	Grass court in the middle, surrounding by pedestrian /light concrete and decorative garden
Height	50 cm from street level	10 - 20 cm from street level
Fixtures	Benches, public toilet, open theatre, sculptures, fountain, decorative garden	Benches, stage, trash container, sculptures, series of flag posts, decorative garden

Waterfront Areas

Apparently urban waterfronts, whether natural or artificial, are now essential ingredients in forming a community image, valuable stages for architectural display and great places for public recreation (Grady Clay, 1998). Manado has successfully built reclamation areas as parts of urban waterfront development to improve environmental quality of seaside area. Major uses of new spaces are commercial and public entertainment, meanwhile people adores some outdoor space for recreation, doing some exercises in the morning, and playing area as public amenity.

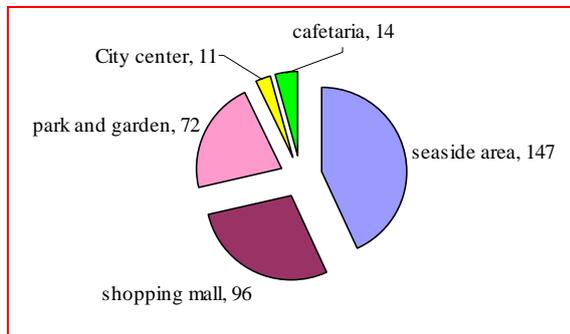


Figure 7: Place prefer to spend the leisure

Seaside area has a special value of serial vision in the city. Design setting in this area for public domain does not need kinds of fixtures except benches faced to the sea. Attractiveness of the sites is panorama of the sea which could interest people to join into the place. In bahu mall, the construction of promenade along the shore could increase the environmental quality and social function of the place. Meanwhile path and sidewalk in Mega mal were not specially designed for walkers; it was just covering by hard surface for the wheels, which makes the place become hot during the day. Some buildings and parking lots are still under construction in certain place on the site. During the weekend, mega mal is very crowded in the morning. People used the road and parking lots for jogging or doing some sport.

Community Open space

Urbanization process, especially population growth and construction development do not proportionally balance with public space provision for accommodate the community activities. Divided into 9 districts official,

Manado city has only 2 official public open spaces representing communal space as neighborhood space, they are Singkil and Malalayang. Both are very limited in use also in size. This situation is consequently lead the neighbors, mainly the children, to use other kind of public space like streets and pedestrian way to play and doing some pleasant things on the dangerous area. Even though the usage and dimension are very limited, people are interested to visit and expected some pleasurable things from the object. Doing fun games, talking with neighbors, sitting and watching the kids play are setting of activities in the object observed. Occasionally, they used for social gathering, religious ceremony, musical concert, or special events.

Tabel.2. Physical condition of two neighborhood space in Bantik Malalayang dan Ketang Baru

Situation	BANTIK	KETANG BARU
Spatial Shapes	Square 58 x 41 m	Square 58 x 63 m
Access	2 entrance gates on south and east sides	2 entrance at north and south sides.
Border lines	Fences and trotoir at south side	Bollard and Streets around with medium traffic density
Dimension of space	2378 m ²	3654 m ²
Materials used	grass court with decorative garden	Grass court
Height	30 cm from street level	10 - 20 cm from street level

According to the adequacy of outdoor facility, respondents of neighborhood area felt the open space in Manado are insufficient in quality and quantity to meet the public need.

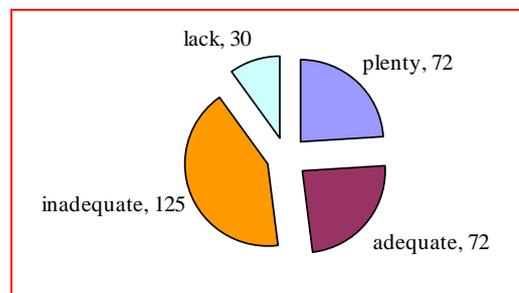


Figure 8: Adequacy of public open space in Manado

CONCLUSION AND REKOMENDATION

This paper analyses the results of an investigation in Manado city, North Sulawesi, into local citizens aspirations for different types of urban open space related to the social functions. The result will serve in the improvement of urban design decision for making renovation of some public space design which will contribute urban greenery system planning in Manado city.

In case of Manado, limitation of number and various activities are caused by spatial condition which could not represent the real need of users. Some activities are taken in wrong places like playing on the parking area or on the street. Some elements of public open spaces are properly unused and inattentive while some other are over capacity, like pedestrian and paving for doing exercises. Public open space is publicly accessible open space which includes streets, civic spaces and parks. Well-designed and managed public space is an integral part of the character, economic attractiveness and uniqueness of a place. The quality of public space plays a major role in the economic, social and environmental sustainability of our cities. According to UU no 27/2007, Indonesia regulation on spatial planning, 30 % of urban land use area should be reserved for urban greenery system. Thus will consequently lead to planning the open space not only as a complementary object, but included in the main system in planning and management of urban land area.

DESIGN RECOMMENDATION

Brief description of design and/or amenity changes recommended to improve the quality of settings as a place for people to use and enjoy in Manado open space are:

- ✚ Quantitatively, urban open space, mainly neighborhood space, should be provided and well distributed in each cluster of human settlement in appropriate size needed and suitable density of population.
- ✚ One focus in one place could avoid visual complexity in urban plaza. Sculptures should be well scaled.
- ✚ Food vendors are supporting elements in public realm, and they should be

accommodated under the certain conditions.

- ✚ Jogging trail should be served in many circumstances, and should be design separately with vehicles.
- ✚ Since the microclimate is very hot, it should be more vegetation and canopy for shading the area (Syafriny R and Sangkertadi, 1999)
- ✚ Night lighting is important element should be provided in each public places.

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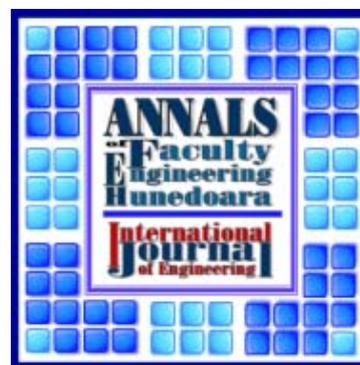
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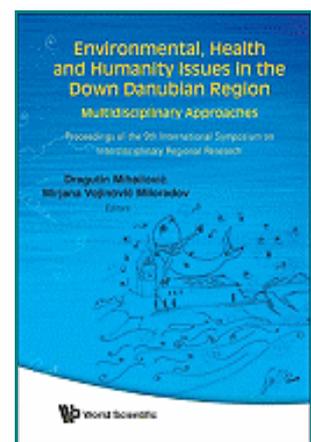
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***ENVIRONMENTAL, HEALTH AND HUMANITY ISSUES IN
THE DOWN DANUBIAN REGION
– MULTIDISCIPLINARY APPROACHES
PROCEEDINGS OF THE 9TH INTERNATIONAL SYMPOSIUM ON
INTERDISCIPLINARY REGIONAL RESEARCH***

edited by **DRAGUTIN MIHAILOVIĆ**
(UNIVERSITY OF NOVI SAD, SERBIA)
& **MIRJANA VOJINOVIĆ MILORADOV**
(UNIVERSITY OF NOVI SAD, SERBIA)



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■ **REVIEW:**

The book: Environmental, Health and Humanity Issues in the Down Danubian Region: Multidisciplinary Approaches, by editors: Dragutin Mihailovic and Mirjana Vojinovic Miloradov, published by World Scientific Publishing Co in 2009, consists of selected papers from the Proceeding of the 9th International Symposium on Interdisciplinary Regional Research, held on University of Novi Sad, Serbia in june, 2007. This Symposium is the result of tripartite regional cooperation

between the University of Novi Sad, Regional Committee of the Hungarian Academy of Sciences — Szeged (Hungary) branch and Interdisciplinary Committee for Research and Development of the Romanian West Zone — Timisoara (Romania), a cooperation that has been ongoing since 1996. The results of joint research projects are presented at the international symposia "Interdisciplinary Regional Research — ISIRR", which are being held cyclically in one of the three countries

■ THE BOOK — IN SHORT PRESENTATION

The awareness about the changing world always introduces an amount of anxiety into man's life that can be defined by the following question: Can man preserve the existing world for the future of his children)

To preserve this world for the future of our children, we must all strive for sustainable development — a development that meets the needs of the present generation without compromising options and resources the future generations will use to meet their own needs. It implies environmentally sound development in societies and regions free from threats to life and property. Human security is an essential ingredient of sustainability, which is increasingly threatened by extreme events, both natural and human-induced.

Regardless of the word balance being used either globally or locally in any given context, it is undoubtedly the keyword in the increasing number of environmental problems. The underlined sketch is a proper introduction to the question: Why are the environmental problems in focus now) One particular answer can be found in the hierarchy of the main scientific problems for the 21st century as seen by the scientific community. According to them, in the 21st century the world of science will be occupied by the problems linked mainly to superconductivity, quantum teleology, extra-terrestrial contacts and environmental problems primarily expressed through the climate change problems. A unique characteristic of those problems is the question of different aspects of the existence of an individual human being. Those questions are: technological capability, origin of the consciousness and survival on the Earth. This is the first time in the history of science that the environmental problems take place at the frontline of science. The question of why this happening now is and why it will go on happening in the future could be answered by the well known fact that in the scientific as well as other worlds the main "drama of the event" takes place at the interface between either two media or two states.

Damages in lives lost and destroyed property are increasing in frequency and magnitude. Increased pollution in the atmosphere is causing gradual increase of the temperature. The slowly rising sea level is threatening low lying countries with more severe storm surges and some scientists suspect that recent large floods, heat waves and drought in Central Europe and the lower Danubian region are indicators of more severe hazardous events in the future. Even more dramatic are human-induced environmental changes caused by population growth, uncontrolled urbanisation and development, and regional conflicts. They result in changes of social and cultural structures, public health, changes of land use and related phenomena, and generating environmental refugees. The environment becomes increasingly endangered, especially when man encroaches on and modifies fragile environments.

■ THE BOOK — CHAPTERS

The book has 371 pages and it is thematically structured in 37 Chapters covering following topics: Part One – Medical Issues, Part Two – Agricultural and Food Technology Issues, Part Three – The Ecological Issues, Part Four – Humanity Issues.

■ THE BOOK — PART ONE

Part One deals with the medical problems in the lower Danubian region. Keynote papers consider medical imaging in general and Positron Emission Tomography (PET). The following chapter papers are devoted to various problems related to the application of DICOM/JPEG2000 Client/Server

Architecture, radionuclide application in therapy and diagnostics and densitometry measurements. Other papers consider problems related to traveler's thrombosis, acute limb ischemia and dentures technology.

■ **THE BOOK — PART TWO**

*Part Two considers the agricultural, technological and developmental open horizons in natural resources of the lower Danubian region. Through applied and fundamental disciplines ranging from biochemistry to physiology, microbiology, applied genetics and food technology, the authors searched for innovations that promote sustainable management of crops and other natural resources in this agriculturally developed region of Europe. The first paper is devoted to the plant antioxidant activity of wild and cultivated *Allium* species, while the second one deals with the antioxidant systems in some rare and endangered species from the southern part of the Pannonian plain. The group of biochemistry papers is closed with the studies of (i) distribution of different forms of cadmium in the intercellular space and cadmium content in roots, stems and leaves of young sugar beet plants and (ii) effect of nickel, cadmium and molybdenum on sugar beet nitrate and protein metabolisms.*

■ **THE BOOK — PART THREE**

The first paper that comes from the physiological background deals with the effect of short-term water deficiency on vascular tissue of petiole and leaf lamina of sugar beet, while the other three treat the effect of nitrate concentrations on physiology of different leaf age groups of poplar. Following is the processes within current or future climate, such as the impact of different methods on uncertainties in lake water budget and (ii) modeling efforts in the pharmacokinetics system with time delay. The last two papers of Part Three, without direct modeling efforts, give examples of investigations, e.g. dealing with characterization of gas/particle partitioning polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) in the area of Kragujevac during the NATO operation in Serbia, and the importance of possible corn production in Hungary in the future, seen through the lens of the climate change.

■ **THE BOOK — PART FOUR**

In Part Four, the papers deal with several aspects of interdisciplinary relation of humanity issues and society through ecology, economy, language and literature. The very first paper analyses statements of interviewed citizens of the city of Novi Sad (Serbia) on measures of local environmental policy and stakeholders who participate in environmental policy actions. Following are two papers based on economic issues. They consider (i) job satisfaction in the state-owned sector of Serbia and (ii) the first public private partnership in Serbia whose socio-economic environment is fruitful for the implementation of new university-industry-government partnership. The last group of papers concern gender relations, Balkan culture and literature. They are a kind of pioneering work which addresses the struggle of getting gender studies recognized as a degree programme in the lower Danubian countries over the past two decades. The first paper from this group focuses on the role of male/female addresses on the same and opposite sexes and investigates how these addresses reflect today's Balkan culture, where women are traditionally in the background and men are in the foreground. The next paper deals with metaphors of cannibalism and the role they play in the female protagonists' reconsideration of their identities in several novels, while in the last one the author discusses two novels from a double perspective: the feminine condition and the role that art plays in the life of the characters.

■ **THE BOOK — GENERAL BACKGROUND**

The book gives the scientific review and correct approach to the Environmental, Health and Humanity issues in a comprehensive and critical way.

Multidisciplinary approaches of considered problems in the Down Danubian Region have been published for the first time for this part of the Western Balkan Region.

*MIRJANA VOJINOVIĆ MILORADOV
&
IMRE KISS*



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The conference is addressed at national and regional government representatives in all countries of South-East Europe, who are involved in the process of policy making in the area of Innovation, Entrepreneurship and Regional Development. Special target group are enterprises, as well as non-governmental organizations active in conference topics.

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We live in a time of change, in a fast evolving, increasingly global and competitive economy. Sustaining a competitive advantage requires that individuals, companies, and nations anticipate, stimulate and manage change rather than simply react to it. This is what entrepreneurship is about: channeling change to your advantage. New ideas generate new realities and this requires knowledge from different disciplines and the ability to combine such insight with the daily practical realities of business life.

We hope that ICEIRD 2010 will give small contribution how to achieve this delicate balance by itself combining both theory and practice, gathering in the same place decision makers (government, ministries- and state agencies), scientists (universities, research and development centres, start-up centres and incubators) and practitioners (SME's) in order to discuss topic that are of crucial importance for national competitiveness and increased regional development in the South East Europe. The key areas of the conference are:

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■ MISSION:

Mission of the International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD) is to strengthen the entrepreneurial spirit and help develop and sustain economic growth by fostering innovation, through the academic knowledge and expertise. ICEIRD Consortium has been established to provide a multi-disciplinary and cross-sectoral forum for researchers, practitioners, and policy makers in the field of innovation and regional development, and a means for sharing findings that promote innovation and therefore enhance economic, technological and regional socio-economic development through new economic activities that stimulate generation of wealth through entrepreneurial and sustainable employment and growth and thus increase competitiveness as well as civil society development and enhancement via the inter-networking of disciplines, researchers, policy makers and practitioners in diverse countries in the region.

The ICEIRD Consortium drives research agenda in the field of technology, innovation and entrepreneurship and regional economic development. It is one of the premium and pioneering consortia that successfully and effectively link theory and practice through well-established research outputs and annual meetings.

■ TOPICS OF INTEREST

Creativity, Complexity and Competitiveness Issues for Small and Medium Enterprises (EU and other)

- ✚ *Leveraging e-skills for Innovation in the Knowledge Society*
- ✚ *Managing and Leveraging Complexity, Creativity and Innovation in SMEs*
- ✚ *Trust, Respect, Culture and Collaboration Issues for SMEs in SEE vs. other regions (EU)*
- ✚ *Leadership and Management practices that can be applied to SMEs*
- ✚ *SME Business process modeling, SME Knowledge management and technology transfer*
- ✚ *New Technology Ventures Financing*
- ✚ *Business incubation management and leadership*
- ✚ *Human Resources Practices for promoting innovation for SMEs*

South East European Entrepreneurial and Innovation Clusters

- ✚ *SMEs' Entrepreneurship as an Innovation Driver*

- ✚ *Opportunities and barriers for closer cooperation between South East European SMEs*
- ✚ *Strategic Integration vs. Flexibility and SME Competitiveness*
- ✚ *Innovation Clusters, Technology Transfer and Social Entrepreneurship*
- ✚ *Social Networking as Driver of EICs formation*
- ✚ *Science & Technology Parks and EICs*
- ✚ *Young and Women Entrepreneurs development via EICs*
- ✚ *Benchmarking of Entrepreneurship and Innovation Best Practices in the region*
- ✚ *Innovation policy in SMEs*

Technology Innovation, Transfer and Commercialization across Governement, University,

- ✚ *The role of the State and Public Policy with regards to SME Innovation and Entrepreneurship*
- ✚ *Governmental and regional policies on entrepreneurship and innovation*
- ✚ *Entrepreneurial Universities and Entrepreneurial Innovation Clusters*
- ✚ *Entrepreneurship education, University – Industry collaboration*
- ✚ *Innovative supply chains, Innovative Supply Chain Management practices in SEE*
- ✚ *SMEs and the role of the Innovation Zone (business centers and incubators)*
- ✚ *Intangibles Valuation and Intellectual Property Rights*

■ IMPORTANT DATES

Submission of camera ready full papers: 23rd April 2010
Early egristration and author registration: 23rd April 2010

■ SCIENTIFIC COMMITTEE – Conference Chair

Dr. Zoran Anisic, University of Novi Sad, Novi Sad, Serbia

■ SCIENTIFIC COMMITTEE – Conference Executives

Dr. Ari-Veikko Anttiroiko, University of Tampere, Tampere, Finland
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Mrs. Cotet Domnica, Mechanical Research Engineering Institute, Bucharest, Romania
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Professor Petko Ruskov, Sofia University, Sofia, Bulgaria
Professor Vojin Senk, University of Novi Sad, Novi Sad, Serbia
Dr. Jaka Vadnjal, GEA College for Entrepreneurship, Piran, Slovenia
Professor Colin Williams, University of Sheffield, Sheffield, United Kingdom

■ SCIENTIFIC COMMITTEE – Committee Members

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Mr. Anthony Gribben, European Training Foundation, Turin, Italy
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Dr. Vladimir Dukovski, Faculty of Mechanical Engineering, Skopje, Macedonia
Dr. Yannick Du Pont, SPARK, Amsterdam, Nederland
Dr. Zoran Anisic, Technical University, Novi Sad, Serbia

GOALS

The objective of ICEIRD Consortium is to establish an effective channel of communication between policy makers, government agendas, academic and research institutions and persons concerned with the latest research, scientific development and practice on innovation and regional development, with the following goals:

- ✚ *To bridge the gap between academic and industry through applied research on technology, innovation and entrepreneurship and regional economic development*
- ✚ *To foster knowledge transfer and collaboration between the academic and industry sectors in emergent technology, system and model contexts*
- ✚ *To organize annual conferences/workshops to meet with members and participants and disseminate latest research and practice*
- ✚ *To publish results of projects in quality academic and professional journals, books, handbooks, proceedings, and reports.*
- ✚ *To generate funding from sources such as local government and research councils for furthering and developing new projects that could benefit the regional and country economy and industry by sharing of experiences and know-how between regions and countries*
- ✚ *To work in partnership with industry on specific entrepreneurial challenges, or innovative ideas*
- ✚ *To drive international research collaboration on projects related to innovation and regional development.*
- ✚ *To serve as the resources and expertise's hub on entrepreneurship and innovation by providing an ICEIRD consortium platform and a knowledge bank.*
- ✚ *To infuse and pump knowledge and expertise into improving the competitiveness of enterprises in developing countries.*
- ✚ *To be the first successful international network that enables exchange and transfer of knowledge, expertise and resources between developed and developing countries (the real global innovative chain)*

■ **BACKGROUND**

The International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD) Consortium was formally established in 2008. It is a multi - disciplinary and cross-sectoral network crossing several streams of theory and practice, namely entrepreneurship, innovation, regional economic development and information systems. The ICEIRD Consortium was set-up with members from institutions jointly researching and collaborating in strategising/organising the annual ICEIRD conference and managing joint projects focused on the theory, policy and practice of entrepreneurship and innovation in particular as it pertains to information technologies. One of the higher concern features of the so-called European Innovation Paradox is the divide between academic research and policy-making, between thinkers and doers. The ICEIRD can become an authoritative reference in bridging this gap by developing analysis in the field of innovation and regional policy, based on high-level academic research, but without neglecting the lessons learnt by policy makers and professionals in the field. Thus establishing experiential feedback learning loops and cross fertilization among two communities which have lived too far away from each other for far too long, and in the European Union in particular.

■ **SUBMISSIONS**

Paper Submission - Academic papers accepted and presented at the conference will be published in the Conference Proceedings. Selected papers will be also published in a special issue of the International Journal for Innovation and Regional Development (IJIRD), Interscience Publisher Ltd. As well as full academic papers, the following submissions are welcomed and will be published in the Booklet of Abstracts:

- **Case Study Submissions** - *Presentations from individuals or companies working in the field*
- **Practitioner Contribution** - *Contributions, either presentations or demonstrations, from individuals or companies working in the field.*
- **Institutional Contribution** - *Contributions, either presentations or demonstrations, from institutions working in the field (agencies, chambers, technoparks, incubators, municipal offices, etc.)*

■ LOCATION

Novi Sad is located in the southern part of Europe, in Serbia and lies on the left bank of the river Danube. It is the second largest city in Serbia.. In contrast to many other European destinations, has the reputation, by full right, of a multinational, multicultural and multi-confessional metropolis in which all differences are seen as advantages. The witnesses to that are Novi Sad Theatre/Újvidéki Színház and University of Novi Sad with 19 faculties and specialized departments at which the lectures are held in languages of national minorities or were founded with that purpose. Still, there are so many other things that represent a daily, lively routine of Novi Sad. Novi Sad is quite sensitive to its bridges. 134 pontoon bridges have been constructed from 1720s until 1920s. The history of these bridges is another story, a story so special that sometimes Novi Sad was called "the town where river runs above the bridges". Novi Sad is a simple city, hospitable and open-hearted to all of its visitors, built by measure of a man. It is a city one gets to know and love easily, but also a place hard to forget and leave forever.

■ CONTACT**Dr Zoran Anisic**

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<http://acta.fih.upt.ro>

THE 1ST CONFERENCE
"MAINTENANCE 2010"

**ODRŽAVANJE 2010
MAINTENANCE 2010**

JUNE 10-13 2010,
ZENICA, B&H

■ **INVITATION**

Faculty of Mechanical Engineering in Zenica organizes the 1st Conference "MAINTENANCE 2010".
Conference objectives are:

- ✚ Gathering of people engaged in maintenance funds for the operation of various aspects and their structural organization,
- ✚ Communication of the research results in the field of maintenance, as theoretical and practical,
- ✚ Exchange of experiences from practical maintenance activities,
- ✚ Transfer of knowledge in the field of maintenance.

Organizing Committee would like to invite all potential authors and participants to submit abstracts (up to 100 words), not later than January 31st 2010.

The official Conference languages are English, Bosnian, Serbian and Croatian.

■ **MAIN TOPICS:**

The Conference will be performed as follows: plenary session (Key papers concerned global topics), symposium (papers according to the conference topics) and workshops, when needed.

We would like to inform all the potential authors to prepare papers in the following topics:

- | | |
|--------------------------------|---------------------------------------|
| ✚ TECHNOLOGY MAINTENANCE | ✚ MENADŽEMENT AND MAINTENANCE |
| ✚ RELIABILITY AND MAINTENANCE | ✚ INFORMATION SYSTEMS MAINTENANCE |
| ✚ LOGISTICS IN THE MAINTENANCE | ✚ NEW TECHNOLOGIES IN THE MAINTENANCE |
| ✚ QUALITY AND MAINTENANCE | ✚ EDUCATION MAINTENANCE |
| ✚ MONITORING AND DIAGNOSTICS | ✚ ECOLOGY AND MAINTENANCE |

■ **ORGANIZING COMMITTEE:**

- | | |
|---------------------------------------|--------------------------|
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| ✚ Dr. SABAHUDIN JAŠAREVIĆ - secretary | ✚ NUSRET IMAMOVIĆ, B.Sc. |
| ✚ Dr. MUSTAFA IMAMOVIĆ, | ✚ MERIM ALIĆ, student |

■ **PROGRAM REVIEW COMMITTEE:**

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| ✚ DR. NIKO MAJDANDŽIĆ (CROATIA) | |

■ IMPORTANT DATES:

Submission of the full paper: April 15th 2010

Registration fee payment: May 15th 2010

Final programme: May 15th 2010

"Maintenance 2010": June 10th-13th 2010

■ TIME AND VENUE:

The conference will be held from 10th to 13th June 2010 in Zenica, Bosnia and Herzegovina. Zenica is a town in the Zenica-Doboj Canton, in the central part of Bosnia and Herzegovina. Area of the city is 500 km², population is about 130 thousand. Economic center of the geographic region of central Bosnia and near Travnik and Jajce, the most important city in that part of the state.

■ CORESPONDENCE ADDRESS:

FACULTY OF MECHANICAL ENGINEERING IN ZENICA Fakultetska 1

- For Conference Maintenance 2010 -

72000 ZENICA

BOSNIA & HERCEGOVINA

You can get all the information regarding the Conference at:

Phone: +387 32 449-143; +387 32 449-145

Fax: +387 32 246-612

You can also contact:

- *Prof.dr. Safet Brdarević*
- *Doc.dr. Sabahudin Jašarević*

E-mail:

- sjasarevic@mf.unze.ba;
- sjasar@yahoo.com;
- sbrdarevic@mf.unze.ba

Conference Maintenance 2010: <http://www.unze.ba/odrzavanje/index.htm>

**VIIth INTERNATIONAL CONGRESS
"MACHINERY, TECHNOLOGY, MATERIALS"
– INNOVATIONS FOR THE INDUSTRY**



**26. – 28.05.2010
SOFIA, BULGARIA**

■ **INVITATION**

The SEVENTH INTERNATIONAL CONGRESS "MACHINERY, TECHNOLOGY, MATERIALS'10" will be carried out together with the EXHIBITION OF MECHANICAL ENGINEERING MECHTECH'10 in Inter Expo Center Sofia.

Together and collaborating these two events will form the industrial forum "MACHINERY, TECHNOLOGY, MATERIALS – INNOVATIONS FOR THE INDUSTRY". We hope that in this way the Congress will become a bigger innovation mediator between scientific research and industry.

The program of the Congress offers you different ways to present the results of your research in front of you colleagues and the representatives of the industry. We invite you to take advantage of these opportunities.

Beside the international congress **MTM'10** and MECHTECH'10 the INDUSTRIAL FORUM includes: EXHIBITION MECHTECH in the halls of INTER EXPO & CONGRESS CENTER OF SOFIA and Innovations exchange and consulting services for the Industry.

We invite you to take part (personally or by correspondence) in the VII INTERNATIONAL CONGRESS **MTM'10** with publishing of your papers or messages on innovative technical solutions for the industry. You are welcome to participate either in the common stand "SCIENTIFIC INNOVATIONS FOR THE INDUSTRY" which is organized by us.

■ **TOPICS:**

01. MACHINES
02. TECHNOLOGIES
03. MATERIALS

■ **SCIENTIFIC PROGRAM:**

- ✚ *PLENARY SESSION with ordered papers*
 - ✚ *SECTIONAL SESSIONS in the congress halls of Inter Expo & Congress center*
 - ✚ *POSTER PRESENTATIONS OF PAPERS at the congress stand in the exposition of the Forum*
 - ✚ *Participation with models, prospects, samples and/or multimedia presentations at the “SCIENTIFIC INNOVATIONS FOR THE INDUSTRY stand in the Forum’s exposition.*
- OFFICIAL LANGUAGES AT **MTM'10**: BULGARIAN, RUSSIAN, ENGLISH
-

■ **PUBLICATIONS:**

- ✚ *In separate volume ISSN 1310-3946 of the proceedings for each topic session, which will be lodged in St.St. Cyril and Methodius National Library and Central Scientific-technical Library in Bulgaria*
 - ✚ *In CD, containing all papers.*
 - ✚ *Detached issue of the International virtual scientific-technical journal “MACHINERY, TECHNOLOGY MATERIALS” (ISSN 1313-0226). This publishing is at will and requires additional payment.*
 - ✚ *Author’s scroll, containing the title page, the content of the volume and printed copy of the author’s paper with the page numbers from the Proceedings.*
-

■ **IMPORTANT DATES:**

- ✚ *Announcement of the plenary and sectional sessions program on our web page: 15.04.2010*
 - ✚ *The Organizing Committee will receive posters up to: 15.04.2010*
 - ✚ *Receiving of the application for transfer: 14.05.2010*
 - ✚ *Registration of the participants: 25 and 26.05.2010*
 - ✚ *Opening of the congress: 26.05.201*
-

■ **TIME AND SPACE:**

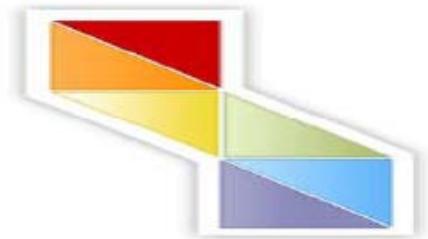
26 - 28. 05. 2010,
Inter Expo Centre,
bul. „Tzarigradsko shose” №147,
SOFIA – BULGARIA

■ **SECRETARIAT:**

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**2ND INTERNATIONAL CONFERENCE
MANAGEMENT OF TECHNOLOGY
- STEP TO SUSTAINABLE PRODUCTION
MOTSP 2010**



**2 – 4 JUNE 2010
ROVINJ, CROATIA**

■ **AIMS AND SCOPE**

International Conference "Management of Technology - Step to Sustainable Production" (MOTSP 2010), will take place from 02-04 June 2010 as a joint project organized by the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Faculty of Graphical Arts, Croatia, Faculty of Management, University of Primorska, Koper and University of Maribor, Faculty of Mechanical Engineering, Slovenia.

The main objective of this International Conference (MOTSP 2010) is to gather international experts from academic entities, research laboratories and industries related to the field of Management of Technology and Sustainable Production. The Conference will also provide a platform for sharing knowledge, ideas and results between science and industry.

The management of technology, the stimulation of innovation and invention and the transfer of technology are considered important challenges of the developed countries and countries in transition.

■ **MAIN TOPICS:**

- ✚ Management of Technology
- ✚ Production, Operation Management
- ✚ Strategic, Engineering Management,
- ✚ Industrial Engineering
 - Operational Research
 - Logistics

- *Production Economics*
- *Decision and Risk Analysis*
- *Manufacturing Costs*
- *Supply Chain Management, Total Quality Management*
- *Forecasting, Technology Foresight*
- *Business Intelligence*
- *Maintenance, etc*
- ✚ *Rapid Prototyping and Manufacturing*
- ✚ *Computer Integrated Manufacturing CAD, CAM, CAPP, CAQ..*
- ✚ *Artificial Intelligence*
- ✚ *Total Cost Assessment*
- ✚ *Sustainable Production*
 - *Product Lifecycle Management (PLM)*
 - *Green Production (BAT)*
 - *Clean Production*
 - *Eco Design*
 - *LCM (Life Cycle Management) & Decision Supports*
 - *LCA (Life Cycle Assessment)*
 - *LCI (Life Cycle Inventory)*
 - *LCIA (Life Cycle Impact Assessment)*
 - *Extended Products*
 - *SLCA (Social Life Cycle Assessment)*
 - *Renewable Sources of EnergyEnergy Efficiency and Audit*
 - *Energy Efficiency and Audit*
 - *Eco Labeling*
 - *Recycling*
 - *Reverse Logistics*
- ✚ *Social Responsibility*

■ GENERAL INFORMATIONS:

*Notification of the acceptance of full papers: **April 15th, 2010***

■ CORRESPONDENCE ADDRESS:

*Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb,
Ivana Lučića 5, 10 000 Zagreb, Croatia
Assoc. Prof. Predrag Čosić, Ph.D.,
Head of Department of Industrial Engineering
Secretary: Nataša Tošanović, B.Sc. Mech. Eng.
Phone 385 1 61 68 355 Fax: 385 1 6157 123
E-mail: motsp2010@fsb.hr
URL: motsp2010.info*

**4TH INTERNATIONAL CONFERENCE
ON MASS CUSTOMIZATION
AND PERSONALIZATION IN CENTRAL EUROPE
(MCP - CE 2010)**



**22 – 24 SEPTEMBER 2010
NOVI SAD, SERBIA**

■ **INVITATION**

On behalf of the Organizational Board and Scientific Committee of the **4th International Conference on Mass Customization and Personalization in Central Europe (MCP - CE 2010)**, we would like to invite you to participate and to share your research ideas, efforts and results with other scientists, dedicated to the idea of Mass Customization, Personalization and Open Innovation.

Mass Customization and Personalization (MCP) aims to provide goods and services that best serve individual customers' personal needs with near mass production efficiency. Open Innovation is focused on cooperation between manufacturers and customers and extends conventional model of closed innovation taking place just within the boundaries of a manufacturer. These new strategies are beginning to emerge in many enterprises as profitable business models.

Organized for the fourth time, the biannual MCP-CE Conference is the leading event in the field of Mass Customization and Open Innovation in Central European Region. After meetings in Rzeszow/Poland (2004/2006), and Palic/Serbia in 2008 the organizers are taking the conference to Novi Sad/Serbia. MCP-CE 2010 provides an interactive platform for learning more about Mass Customization and Open Innovation strategies and the possibility to discuss the latest technologies and enablers like Product Configurators and Toolkits for User Innovation. The main goal of the conference is to bring the Mass Customization and open Innovation concept closer to companies and scientists in Central Europe. Join us for MCP-CE 2010 in Novi Sad, where developers, business people, and researchers interact with entrepreneurs and corporate managers looking for applications in order to gain competitive advantage in times of financial crisis.

We wish you very warm welcome to the Conference and hope that together we will make the MCP concept more popular and useful.

■ **MAIN TOPICS:**

- ✚ *MCP and Open Innovation in times of financial crisis*
- ✚ *MCP Strategies and Economics*
- ✚ *MCP Product and Process Design*
- ✚ *MCP Manufacturing and Logistics*
- ✚ *MCP Information Systems*
- ✚ *MCP Communities and Personalization in E-commerce*
- ✚ *MCP and Services*
- ✚ *MCP and CRM/Branding*
- ✚ *MCP Case Studies: Industrial Goods, Consumer Goods, Services*
- ✚ *Open Innovation Models*
- ✚ *Open Innovation Tool-Kits*
- ✚ *Open Innovation Case studies*

■ **IMPORTANT DATES:**

Final paper submission deadline: 15th July 2010

Final notification: 31st July 2010

Registration and payment deadline: 1st September 2010

■ **CONFERENCE PROGRAM:**

22nd September, Wednesday

Pre conference workshop

Ice breaking meeting

23rd September, Thursday

Conference opening

Plenary session

Conference sessions

Official banquet

24th September, Friday

Conference sessions

Conclusions and Conference Closing

Trip to Fruška Gora Monasteries

■ **CORRESPONDENCE ADDRESS:**

Chairman: ZORAN ANIŠIĆ,

UNIVERSITY OF NOVI SAD, SERBIA

FACULTY OF TECHNICAL SCIENCES

Trg Dositeja Obradovića 6,

21000 Novi Sad, Serbia

azoran@vts.su.ac.rs

<http://www.ftn.ns.ac.yu/MCP-CE2010/info.php>

**10th INTERNATIONAL MULTIDISCIPLINARY
SCIENTIFIC GEOCONFERENCE & EXPO
SGEM 2010
MODERN MANAGEMENT OF MINE PRODUCING,
GEOLOGY AND ENVIRONMENTAL PROTECTION**



**20-25 JUNE 2010
ALBENA SPA & RESORT COMPLEX, BULGARIA**

■ **INVITATION**

We are pleased to inform you that the 10th Anniversary International Multidisciplinary Scientific GeoConference SGEM 2010 will be held in the period of 20-25 of June, 2010 at **FLAMINGO GRAND congress centre of ALBENA SPA & Resort Complex, Bulgaria.**

Continuing the tradition of previous SGEM conferences, SGEM2010 will bring together again researchers, educators, and experts representing research and educational institutions, companies, government agencies and consulting organizations from all over the world to discuss on the questions concerning the contemporary geosciences, to exchange ideas and to propose potential solutions of problems related to the global changes.

The new aspects of the 10th Anniversary International Multidisciplinary Scientific GeoConference are:

- **Parallel scientific sessions.** Besides conference Hall FLAMINGO GRAND (capacity of 250 seats) another three new conference halls will be available (capacity of 80, 120 and 170 seats);
- **Separated MD/PhD sessions;**
- **Special workshops** will be conducted as a parallel to the conference events;
- **Paper abstracts will be accepted for publishing and presentation after double-blind peer review process;**
- **Presenting new special exhibits of rocks and mineral specimens and fossils;**
- **Enlarging SGEM EXPO** popularity and increasing its participants;
- **SGEM participants will receive a special reduction in the price of many entertainment services** in Albena Complex as - riding, paintball, tennis, carting, fitness, spa-procedure and many more...

The OnLine registration in the 10th Anniversary International Multidisciplinary Scientific GeoConference SGEM 2010 & EXPO HAS JUST OPENED.

You are welcome to join this event. For more information, please visit our website: www.sgem.org
Looking forward to welcoming you at the 10th GeoConference & EXPO - SGEM 2010!

■ **MAIN TOPICS:**

1. Section "Geology"
2. Section „Hydrogeology, Engineering Geology and Geotechnics"
3. Section "Exploration and Mining"
4. Section „Mineral Processing"
5. Section "Oil and Gas Exploration"
6. Section „Applied and Environmental Geophysics"
7. Section „Geodesy and Mine Surveying"
8. Section „Photogrammetry and Remote Sensing"
9. Section „Cartography and GIS"
10. Section „Informatics"
11. Section „Geoinformatics"
12. Section „Micro and Nano Technologies"
13. Section „Hydrology and Water Resources"
14. Section „Marine and Ocean Ecosystems"
15. Section „Forest Ecosystems"
16. Section „Soils"
17. Section „Air Pollution and Climate Change"
18. Section „Renewable Energy Sources and Clean Technologies"
19. Section "Nuclear Technologies"
20. Section "Ecology and Environmental Protection"
21. Section „Recycling"
22. Section „Environmental Economics"
23. Section „Education and Accreditation"
24. Section "Environmental Legislation, Multilateral Relations and Funding Opportunities"

■ **IMPORTANT DATES:**

Full paper Submission: 10 May 2010

Poster Submission: 20 May 2010

Registration and payment for participants WITH papers: 10 May 2010

LATE Registration and payment for participants WITH papers /you should pay registration fee +15% in addition, if NOT your paper/s will be excluded from the proceedings and the programme:

11 - 20 May 2010

Registration and payment for other participants /after that date you should pay registration fee +15% in addition: 30 May 2010

Booking Hotel by Name: 1 May 2010

■ **CORRESPONDENCE ADDRESS:**

URL: <http://www.sgem.org>

E-mail: sgem@sgem.org

Fax: +359 2 817 24 77

**THE 6TH INTERNATIONAL SYMPOSIUM
"SHAPE, MECHANICAL AND INDUSTRIAL DESIGN
OF PRODUCTS IN MECHANICAL ENGINEERING 2010"**



**29 - 30 September 2010,
Hotel Prezident, Palić, Serbia**

■ **INVITATION**

Dear colleagues,

We kindly invite You to join the 6th International Symposium "KOD 2010" which will take place on 29th and 30th September 2010 in Hotel Prezident in Palić, near Subotica, Serbia.

The basic goals of this symposium are:

- ✚ to assemble famous investigators and practitioners from faculties, scientific institutes and different enterprises or other organizations,
- ✚ to enable presentation of new knowledge and exchange of practical experience in mechanical engineering, industrial design and shaping, and
- ✚ to propose theoretically developed and practically tested solutions for improving the quality of products in mechanical engineering in order to achieve the highest possible position on the international market.

■ **PAPER SUBMISSION:**

Abstracts (with paper title, names of the author and coauthors with addresses and contacts) should be submitted **before May 20st 2010**. The content of the abstract should not exceed 200 words.

The number of papers is limited. One person can sign two papers at the most, but only one paper as the first author. Detailed editing requirements concerning papers to be printed will be sent to participants upon receiving preliminary applications.

All abstracts of papers with payed participation fee will be printed in symposium proceedings of abstracts and published in symposium CD. A significant number of papers that pass reviewing of Journal of Mechanical Engineering Design will be published in the next few issues of the journal.

The official languages of the symposium is **English**.

ORGANIZERS:

University of Novi Sad, Faculty of Technical Sciences Novi Sad
ADEKO – Association for Design, Elements and Constructions Belgrade
Honorary Chairman of the Symposium KOD 2010: Kosta KRSMANOVIĆ
Faculty of Applied Arts and Design, Belgrade
Chairman of Organizing committee: Siniša KUZMANOVIĆ
Faculty of Technical Sciences, Novi sad
Chairman of Scientific committee: Vojislav MILTENOVIĆ
Faculty of Mechanical Engineering, Niš

IMPORTANT DATES:

Abstracts submission deadline **20.05.2010.**
Notification of acceptance of the abstracts and instructions for
preparing the papers with participation conditions **01.06.2010.**
Final paper submission deadline **01.08.2010.**
Confirmation the acceptance of the papers **20.08.2010.**
Payment of the Registration fee and Final programme **10.09.2010.**
Registration **29.09.2010**

MAIN TOPICS:

The major subject of this Symposium is design of product, researched regarding to its:

✚ function,	✚ operating life,	✚ handling,
✚ purpose,	✚ efficiency,	✚ exploitation,
✚ structure,	✚ price,	✚ service,
✚ size,	✚ production method,	✚ maintenance,
✚ material,	✚ assembling,	✚ hygienic requirements,
✚ mass,	✚ numeration,	✚ repair,
✚ ergonomics requirements,	✚ testing,	✚ atmospheric influence,
✚ worker protection measures,	✚ conservation,	✚ biological factors,
✚ aesthetic demands,	✚ package,	✚ recycling,
✚ production volume,	✚ storage,	✚ ecology,
✚ delivery date,	✚ transportation,	✚ unexpected breakdowns,
✚ quality,	✚ deconservation,	✚ special demands,
✚ reliability,	✚ mounting,	✚ personal demands.

CORRESPONDENCE ADDRESS:

KOD 2010 - Faculty of Technical Sciences
21000 Novi Sad, Serbia
Trg Dositeja Obradovica 6
www.kod.ftn.uns.ac.rs
E-mail: kod2010@uns.ac.rs
fax: +381 21 6350 592
tel: +381 21 485 2358; +381 64 153 22 67; +381 64 190 31 04

**5th INTERNATIONAL ICQME CONFERENCE
(QUALITY, MANAGEMENT, ENVIRONMENT, EDUCATION, ENGINEERING)**

ICQME 2010

**Center for Quality
Faculty of Mechanical Engineering in Podgorica
University of Montenegro
16th – 17th August 2010
TIVAT, MONTENEGRO**

■ **INVITATION**

It is our pleasure to invite you, on behalf of the Organizational Committee, to the Fourth International ICQME Conference that will be held in Paris between 16 and 17 September, 2010.

The idea of Conference has first come to life when a need was felt to have the eleventh traditional National Conference on Quality Management System (SQM) with the international participation evolve into an international conference, with an extension of thematic areas to be covered.

National Conference on Quality Management System (SQM) with the international participation has been gathering prominent experts from the field of quality over the last twelve years. In addition to the local, Montenegro experts, the participation lists included a number of well-known scientists and experts from France, Spain, Canada, England, Italy, Denmark, Slovenia, Serbia, Bosnia-Herzegovina, Croatia, and 5th International ICQME Conference some of the vital issues of quality, management, engineering, education, and environmental protection will be discussed, and the participants will be from both the university and the commercial fields, which will contribute to a more productive exchange of ideas and experiences.

The conference intends to shed further light on the complex and potentially conflicting choices firms take in order to acquire, exchange, and create knowledge in order to improve its performance.

This theme relates to quite a wide variety of aspects relating to the increasing complexity (e.g. economic, management, engineering, sociology) of systems for knowledge creation and innovation.

This complexity implies a more intensive and more frequent need to embrace as well as to connect both internal and external source of knowledge in the search for new technological achievements.

■ **MAIN TOPICS:**

- ✚ *International Quality Standards ISO 9000*
- ✚ *Voluntary approaches for quality improvement*
- ✚ *International Environmental Standards ISO 14000*
- ✚ *Voluntary approaches for environmental regulation*
- ✚ *OHSAS 18000- Occupational Health and Safety Zone*
- ✚ *International standard ISO 22000-Food safety Management Standard*

- ✚ *New Technologies*
- ✚ *Benchmarking*
- ✚ *Six Sigma*
- ✚ *Supply Management Chain*

■ IMPORTANT DATES:

Notification of abstract acceptance: 01.04.2010.

Paper submission: 01.06.2010.

Notification of paper acceptance: 01.07.2010.

■ ORGANIZERS:

- ✚ *Adolfo Senatore, University of Salerno, Italy*
 - ✚ *Alireza Lari, Fayetteville State University, USA*
 - ✚ *Andjelko Lojpur, University of Montenegro, Montenegro*
 - ✚ *Arsov Ljupco, University in Skoplje, Macedonia*
 - ✚ *Baki Karamis, Erciyes University, Turkey*
 - ✚ *Darko Petkovic, University in Zenica, (BIH) Federation of Bosnia and Herzegovina*
 - ✚ *Duško Pavletić, University of Rijeka, Croatia*
 - ✚ *Georgios Petropoulos, University of Thessaly, Greece*
 - ✚ *Jaroslava Hyrlova, University of Pardubice, Czech Republic*
 - ✚ *Jovan Filipovic, University in Belgrade, Serbia*
 - ✚ *Marc-Arthur Diaye, University d'Evry, France*
 - ✚ *Milan Perovic, University of Montenegro, Montenegro*
 - ✚ *Milan Vukcevic, University of Montenegro, Montenegro*
 - ✚ *Milenko Heleta, "EDACTA" Consulting, Belgrade, Serbia*
 - ✚ *Miodrag Bulatovic, University of Montenegro, Montenegro*
 - ✚ *Mirko Sokovic, University of Ljubljana, Slovenia*
 - ✚ *Miroslav Bobrek, University in Banja Luka, Republic of Srpska*
 - ✚ *Mitar Perusic, University in East Sarajevo, Republic of Srpska*
 - ✚ *Nedeff Valentin, Universitatea din Bacau, Romania*
 - ✚ *Pavel Castka, University of Canterbury, New Zealand*
 - ✚ *R.A. Mahdavejad, University of Tehran, Iran*
 - ✚ *Ratko Uzunovic, VIBEX systems Beograd, Serbia*
 - ✚ *Sead Jahić, IDEA, Bosnia and Herzegovina*
 - ✚ *Slavko Arsovski, University in Kragujevac, Serbia*
 - ✚ *Stanislav Karapetrović, University of Alberta, Canada*
 - ✚ *Stanisław Tkaczyk, Silesian University of Technology, Glowice, Poland*
 - ✚ *Svetlana Cicmil, University of the West of England, UK*
-

■ CORRESPONDENCE ADDRESS:

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E-mail: zdravkok@ac.me
Home page: <http://www.qme-conference.org>

**INTERNATIONAL SYMPOSIUM
on ADVANCED ENGINEERING
& APPLIED MANAGEMENT
– 40th ANNIVERSARY
in HIGHER EDUCATION
(1970-2010)**



**4 – 5 NOVEMBER, 2010
HUNEDOARA, ROMANIA**

■ **INVITATION**

*It is our privilege and pleasure to extend a cordial invitation to you and your colleagues to attend the **Symposium**, which will ensure an exchange of scientific information and didactical opinions in fields with an impressive dynamic considering the research and the technological progress.*

The Symposium is an open invitation for all specialists, professors, researchers and experts in all scientific fields, who can produce a free presentation of the results in their scientific activities.

*For more information please contact the **Secretary Office of the Organizing Committee**. An e-mail address was be opened to receive your correspondence: symposium@fih.upt.ro*

■ **MAIN TOPICS:**

- ✚ **MATERIALS SCIENCE & ENGINEERING**
- ✚ **ELECTRICAL ENGINEERING & ENERGETICS**
- ✚ **INFORMATICS & COMPUTER SCIENCE**
- ✚ **MECHANICAL ENGINEERING & DESIGN**
- ✚ **MANAGEMENT IMPLEMENT POLICIES & STRATEGIES**
- ✚ **ENVIRONMENTAL ENGINEERING & ECOLOGY**

■ IMPORTANT DATES:

- ✚ For the paper selection, you are kindly invited to submit a maximum 200 words abstract and post it to the address of the Symposium by **15 July 2010**, stating the section in which the papers will be presented.
 - ✚ Notification of acceptance, instructions for preparing camera-ready manuscripts, financial and other details will be sent by **15 September 2010**.
 - ✚ The camera-ready manuscript of your paper must be sent to the **Secretary Office** by **01 October 2010**.
 - ✚ The final announcement of confirmation for publishing and the day of your paper presentation will be sent by **30 October 2010**.
-

■ SCIENTIFIC COMMITTEE

- ✚ Prof. dr. eng. **Teodor HEPUT**
dean of the Faculty of Engineering – Hunedoara
 - ✚ Prof. dr. **Stefan MAKSAJ**
scientific secretary of the Faculty of Engineering – Hunedoara
 - ✚ Prof. dr. eng. **Francisc WEBER**
head of General Association of the Romanian Engineers (AGIR) – branch of Hunedoara
 - ✚ Assoc. Prof. dr. eng. **Ana Virginia SOCALICI**
vice-dean of Faculty of Engineering – Hunedoara
 - ✚ Assoc. Prof. dr. eng. **Caius PANOIU**
vice-dean of Faculty of Engineering – Hunedoara
 - ✚ Assoc. Prof. dr. eng. **Sorin DIACONU**
head of Electrical Engineering & Industrial Informatics Department
 - ✚ Assoc. Prof. dr. eng. **Lucia VILCEANU**
head of Engineering & Management Department
 - ✚ Assoc. Prof. dr. eng. **Manuela PANOIU**
head of Life-Long Education Department
 - ✚ Assoc. Prof. dr. eng. **Imre KISS**
Romanian Foundry Technical Association (ATTR) – branch of Hunedoara
-

■ ORGANIZING COMMITTEE

- ✚ Lect. ec. dr. eng. **Vasile ALEXA**
 - ✚ Lect. dr. eng. **Sorin RATIU**
 - ✚ Lect. dr. eng. **Gabriel POPA**
 - ✚ Lect. dr. eng. **Vasile George CIOATA**
 - ✚ Lect. dr. math. **Dan LEMLE**
-

■ LOGISTICAL SUPPORT:

All accepted papers of **Symposium** will be published into the Symposium Proceeding. Selected and expanded papers which were orally presented at the Conference will be considered for publication in **ANNALS of F.E.H. – INTERNATIONAL JOURNAL OF ENGINEERING** and **ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING** as full-length research papers after reviewing and appropriate revisions.

The logistical support will be assured by the **ANNALS of F.E.H. – INTERNATIONAL JOURNAL OF ENGINEERING** and **ACTA TECHNICA CORVINIENSIS – BULLETIN OF ENGINEERING** (B+ International Scientific Journals according with the CNCSIS classification, indexed in Index Copernicus, Evisa and JournalSeek Genomics)

**INTERNATIONAL RESEARCH CONFERENCE
EDUCATION, RESEARCH & DEVELOPMENT**



SEPTEMBER 9 - 13, 2010,
SUNNY BEACH RESORT, BULGARIA

■ **ORGANIZERS:**

Organized by: Bulgarian Academy of Science, Union of Scientists in Bulgaria and Foundation Science & Education

Sponsored by: Info Invest – Bulgaria (www.ScienceBg.Net)

Scientific media partner: Journal of International Research Publications: Educational Alternatives

The symposium is part of the scientific events organised annually by Info Invest, the Science and Education Foundation and its partners. www.science-edu.eu

■ **SYMPOSIUM ANNOUNCEMENT AND CALL FOR PAPERS:**

We are pleased to invite you to take part in the **EDUCATION, RESEARCH AND DEVELOPMENT** Conference, which will be held on 9 – 13 September 2010 in Sunny Beach, Bulgaria.

■ **TOPICS:**

The scope of ER&D 2010 includes the following topics:

KNOWLEDGE - A PRIMARY FACTOR FOR PRODUCTIVITY AND ECONOMIC GROWTH

- ✚ Education under market economy. Competitive education.
- ✚ The role of education in creating an information society and technologies
- ✚ Education and research, demographic processes and labour market
- ✚ Equal access and wider participation in education
- ✚ Government regulation and legislation
- ✚ Structure, management and funding
- ✚ Intellectual property education and research

SOCIALIZATION OF YOUTH IN CONTEMPORARY SOCIETY

- ✚ Problems of a humanisation of education
- ✚ Problems of safety of education
- ✚ Creative activity
- ✚ Technologies of continuity in education.
- ✚ Art education
- ✚ Training in multicultural education space
- ✚ Intercultural communication. The system of values in the dialogue of cultures

EDUCATION, INDIVIDUAL AND SOCIETY

- ✚ Pedagogics and Methodology of Education
- ✚ Psychological and pedagogical content of educational activities

- ✚ *Integration of cross-cultural studies in the curriculum*
- ✚ *General and vocational education*
- ✚ *Pre-school education*
- ✚ *Extra-curricular and out-of-school activities*
- ✚ *Education through life*
- ✚ *Alternative Education*
- ✚ *Education of children and pupils with special educational requirements and / or chronic diseases*
- ✚ *Personnel, scientific, information and library services*
- ✚ *Quality of teaching, training programs and assessment*

HIGHER EDUCATION: GLOBALIZATION AND INTERNATIONALIZATION

- ✚ *Higher and Further Education: new challenges*
- ✚ *Students and Teachers: exchange programs*
- ✚ *Higher Education and Bologna Process*
- ✚ *Application of European system for accumulation and transfer of credits (ECTS)*
- ✚ *Erasmus: implementation and results at universities*
- ✚ *The internationalization of Universities*
- ✚ *Research and Education Networks*
- ✚ *International projects and innovations*
- ✚ *University-Industry: Partnership, Programs, Experience*
- ✚ *Assessment of students*

SCIENTIFIC RESEARCH: RESULTS AND PERSPECTIVES

- ✚ *Scientific Research centers: achievements and new ideas*
- ✚ *Research of Technologies in Education*
- ✚ *International cooperation in the sphere of research*
- ✚ *Research of various aspects of innovative society*
- ✚ *Research methodologies*
- ✚ *Academic research projects*
- ✚ *Interconnection between education and research*
- ✚ *University/Industry/Government: collaborative partnership in research*

E-LEARNING AND VIRTUAL INNOVATIONS

- ✚ *E-learning: projects and results*
- ✚ *E-learning: pedagogical strategies and tactics*
- ✚ *Developing e-learning methods for specific fields*
- ✚ *Online laboratories and classrooms*
- ✚ *Virtual universities*
- ✚ *Electronic library: information and searching technologies*
- ✚ *Electronic journals and books: projects and prospects*

Note: Only those who have submitted their registration form, fulfilled all the requirements in the present Call for Papers and present at the symposium are regarded as symposium participants.

■ **DATES AND VENUE:**

9 - 13 September 2010, the Imperial Hotel, Sunny Beach
Registration of participants: 5 – 6 pm, 9 September; 9 – 10 am, 10 September
Inauguration of the conference: 10 September
Closing of the conference: 13 September

■ **PARTICIPATION FORMS:**

- ✚ *oral and poster presentations;*
- ✚ *online presentations: for people who can not attend in person. All these participants receive all the certificates and documents after the Symposium through the Internet. All their contributions are also included in Publications.*

■ **CONFERENCE LANGUAGES:**

English, Russian and Bulgarian. The main conference language is English.

■ SUBMISSIONS:

There is a limit of two contributed submissions per registered author. They may be presented as a talk or as a poster. Oral presentations are 10 minutes long and a poster session lasts one hour.

■ PRESENTATION EQUIPMENT:

Participants can use a PC and a multimedia projector. Presentations have to be prepared using PowerPoint and stored on a USB flash drive. Presentations are emailed to the organisers prior to the conference with the file name displaying the participant's name and surname.

■ PUBLICATION:

*Submissions, no matter whether presented as talks or posters, will be published in the **International Scientific Publications: Educational Alternatives** journal in cooperation with the Science and Education Foundation. You can get more information about the journal at www.science-journals.eu.*

Journal description: 750 MB CD-ROM disc in a box; papers are in Flash format, allowing for full-colour printouts. To see what a published paper looks like, please go to www.science-journals.eu

Protection and identification: The journal is reliably protected using special technologies. It is identified with an ISSN (International Standard Serial Number).

Editing and reviewing: Every paper is reviewed by two independent, anonymous reviewers.

Journal languages: English

Copyright: Authors retain copyright of the published papers and have full responsibility for their contents. The publisher has the unlimited right to offer and distribute the edition with the papers published in it. The publisher assumes no responsibility whatsoever if the authors have inflicted harm or damage to any third parties.

■ DISCLAIMER:

As an organiser of the symposium, Info Invest Ltd assumes no responsibility whatsoever, direct or implied, for the contents of the papers as well as for the consequences arising from misinterpretation or unawareness of the requirements for participation. The fact that you have submitted a registration form for the symposium means that you have read and agreed with the present conditions.

■ IMPORTANT DATES:

 30.03.2010: Registration form and abstract (up to 10 lines) submission deadline. You will be notified about acceptance/rejection with an email from the organising committee within five working days of receiving the submission. You can register online at

 <http://www.sciencebg.net/symposiums/registration/registration-form.html>

 If you should receive no reply, please contact the organisers by email or telephone;

 30.04.2010: Deadline for transferring the registration fees to the account given in the email sent to the participant by the organising committee. All bank charges and commissions are paid by the participants. Please inform your bank about this when ordering the transfer. Payment on site is not allowed;

 30.04.2010: Final paper submission deadline. Please send your paper written according to the formatting requirements to the organisers for publication at symposium@sciencebg.net. You will be notified whether the paper is accepted for publication with an email from the organising committee within five working days of receiving the paper. If you should receive no reply, please contact the organisers by email or telephone;

 Deadline for booking accommodation for the participants and their accompanying persons. After this deadline, the organisers have no responsibility to arrange accommodation for the participants.

 5 pm – 6 pm, 9 September and 9 am – 10 am 10 September: Registration of participants;

 10 September: Opening of the symposium;

 13 September: Closing of the symposium

■ PARTICIPATION AND REGISTRATION:

Participation: Only fully registered participants, their accompanying persons and special guests of the Organising Committee can take part in the symposium. Unregistered attendance is not allowed.

Registration: 5 pm – 6 pm on 9 September and 9 am – 10 am on 10 September. Please tell your country, name and surname at the registration desk. Accompanying persons do not have to register, but they receive a badge saying VISITOR.

Name Badges: The badge with your name that you get together with the symposium materials at registration is personal. It is the only document giving free access to the symposium hall and should be clearly visible at all times. You may be denied access to the symposium if you cannot show it. The organisers have the right to demand a proof of your right to attend the symposium.

■ SOCIAL ACTIVITIES:

The social programme is of paramount importance for the success of the symposium. The informal atmosphere of the activities helps you to expand your social contacts with the rest of the participants. You will be informed about the events and times of the social programme additionally. A complete description of the provided activities will be published at <http://travel.sciencebg.net>.

■ TRAVEL AND JOINING INSTRUCTIONS:

There are three main international airports in Bulgaria: in Sofia (430 km from Sunny Beach), Varna (90 km from Sunny Beach) and Burgas (35 km from Sunny Beach).

There are several different ways to get from Sofia, Varna or Burgas to Sunny Beach.

✚ by bus: Please note that you can take a bus from Sofia or Varna to Sunny Beach, but there is no public bus service from Burgas Airport to Sunny Beach. To go to the bus station in Sofia or Varna, take a taxi from the airport. It is advisable to ask the taxi driver approximately how much the trip will cost before getting into the car as he may overcharge you later.

✚ There are buses from Sofia or Varna to Burgas on the hour. Take those buses which stop at Sunny Beach or Nesebar. Alternatively, you can travel to Burgas, but then you will have to take another bus to Sunny Beach (45 km away). The journey from Sofia to Sunny Beach is approximately 7 hours and from Varna to Sunny Beach approximately 1 hour 30 min.

✚ by car: you can order a car from the selected hotels which we offer to book for you. Please inform us by email to send you the necessary information. The hotel will issue an invoice for the amount you pay.

✚ by taxi: we recommend that you use a taxi from Burgas Airport to Sunny Beach. It will be too expensive to travel by taxi from Sofia or Varna, unless you are a group of three or four.

■ FURTHER INFORMATION:

Further information will be periodically available on this website. Any queries about the organisation and programme of the symposium should be addressed to Mr Ivan Genov, symposium coordinator and director of Info Invest Ltd, Burgas. Please visit <http://www.facebook.com/ivan.genov1>

email: office@sciencebg.net

Send your materials to: symposium@sciencebg.net

**GENERAL GUIDELINES
FOR PREPARATION OF MANUSCRIPTS
FOR REVIEW IN
ACTA TECHNICA CORVINIENSIS
– BULLETIN OF ENGINEERING**

■ **Abstract:**

*a maximum 100 words abstract will be written, simple spaced, in **ENGLISH***

■ **Keywords:**

a maximum 10 representative words for the paper

■ **THE TEXT**

*The submitted manuscript must be content **INTRODUCTIVE NOTES (INTRODUCTIONS)**, follow by the **METHODOLOGY**, the **PRELIMINARY RESULTS** or the **FINAL RESULTS**, and, in final, the **CONCLUSIONS** about the presented notes.*

*Also, the paper included the **ABSTRACT, KEYWORDS, and REFERENCES**.*

The conclusions must be clear, relevant and must be indicate some the empirical, theoretical, methodological or scientific aspects of the research, and the author's contributions, or the future preliminaries of our research. It will publish empirical, theoretical and methodological articles.

■ **THE TABLES, FIGURES, GRAPHS AND EQUATIONS**

Tables and Figures should be numbered, titled and the resource should be mentioned below them. Photographs in the text are preferable to be in black and white, but must be clear, with a high contrast. Under each figure there will be typed, centered, "Figure X. Name of the figure".

Tables will be part of the text, designed as "Table y. Name of the table", written above the table, centered.

The equations will be inserted in the text – left aligned – and will be numbered with Arabian figures, in round brackets, right aligned. Before and after the equation a blank line will be left.

■ **SUBMISSION OF MANUSCRIPTS**

The original of the technical paper will be sent through e-mail as attaché document (.doc, Windows 95 or higher).*

■ **ACKNOWLEDGMENT**

If is necessary, please write yours works based research [Title, Contract no., Team, Year etc]

■ **REFERENCES**

[1] *AUTHORS. YEAR. TITLE OF REFERENCE, JOURNALS NAME, VOLUME, PAGES*

[2] *AUTHORS. YEAR. TITLE OF BOOK, EDITING HOUSE*

[3] *AUTHORS. YEAR. TITLE OF REFERENCE, CONFERENCE NAME, VOLUME OR PROCEEDING, PAGES*

■ **AUTHORS & AFFILIATION**

¹ *NAME SURNAME*

² *NAME SURNAME*

¹ *DEPARTMENT, FACULTY, UNIVERSITY, COUNTRY*

² *INSTITUTION OR COMPANY, COUNTRY*



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– BULLETIN of ENGINEERING**

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