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METHODOLOGY FOR AN IMPLEMENTATION OF THE DRAWINGLESS MANUFACTORING

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Abstract: In this paper, there are presented the proposal steps to be taken for smart working of the integrated manufacturing system using no drawings. This contribution deals with the activities which are focused on the devices at our institute. These devices are parts of the computer integrated manufacturing. This paper deals also with knowledge about PMI information, and with the smart working with it in drawingless environment.
Keywords: iCIM3000, drawingless, CIM, PMI

INTRODUCTION

Modern information technology has opened up new possibilities of flexibilization and cost reduction in production. The development of information technology has brought in mechanical engineering the phenomenon of designing in 3D virtual environment, which enables designers to instantly obtain a far greater insight into the structure and level of detail than is possible when designing in 2D environment. One of these possibilities is the manufacturing using no drawings. Nowadays are drawings only information carriers and they are useful only in their electronic forms. Thereforewill be in this article personated some reasons why we have to choose the manufacturing with no drawing and some manners in wich we should move in. In other, there will be presented why is the PMI good for this implementation,and basic steps how to begin work with this information in effective way.

ICIM SYSTEM

Production with integration of computer support in all phases of the production system, in which all of these phases are connected with each other it is called computer-supported production (Computer Integrated Manufacturing – CIM). It is a network of connected computers includes activities related to the production, starting with the product marketing and ending with expedition to the customer [1, 2].

CIM - Computer Integrated Manufacturing - is a concept for the structuring of industrial enterprises. Manufacturing technologies demand a CIM concept which can be realized through the capabilities of information processing available today. The idea of integrating different areas of CIM, such as production planning and control (PPC), computer aided design (CAD) and computer aided manufacturing (CAM), is explained through operating chains and put into a CIM architecture based on a hierarchy of EDP systems [3].

If the CIM is a computer controlled production, iCIM is then open system of computer controlled production of CIM. ICIM 3000 is a training and open model system of CIM made by company FESTO. On Fig.1 we can see the 3D model of iCIM by FESTO. This system consists of stations which are marked on fig. 1 by numerical character 1-8.

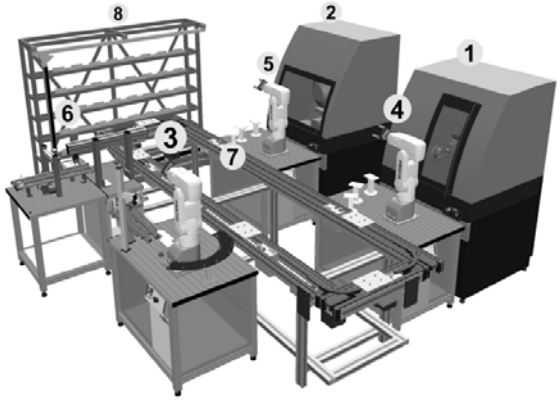

Figure 1. The 3D model of iCIM by FESTO [4, 5]
1-Concept Turn, 2-Concept Mill, 3-Flexible Robot Assembly Cells, 4,5-Service robots of concept machines , 6-Pallet Handling and Quality Station, 7-Pallet Transfer System, 8- Automatic Storage / Retrieval System

Transport system

In the whole system, transport system is responsible for the transport of work-pieces which are placed upon special work-piece carriers.

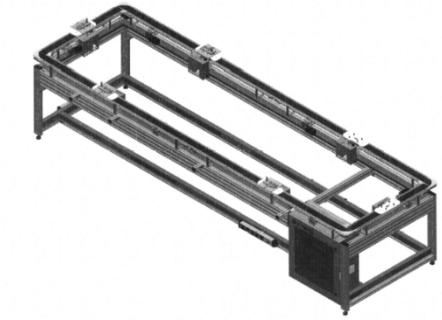

Figure 2. Transport system [4]

Quality handling station

The quality handling station (fig. 3) is responsible for the work piece (pen holder) testing and the manual feeding of the system with pallets. The pallet handling is done by a linear handling and the testing is executed with an analogue positional transducer and additional camerasystem.[4, 5]

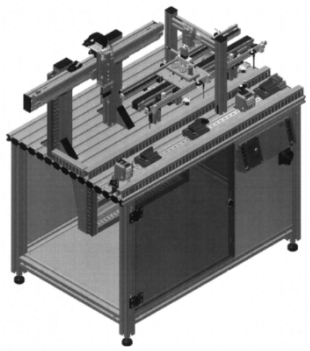

Figure 3. *Quality Handling station [4]*

Robot assembly station

The robot assembly station (fig. 4) has the function to assemble desksets, In dependence of the order, the robot assembles the desk set. Once the desk set has been assembled it is moved to the AS/RS station.

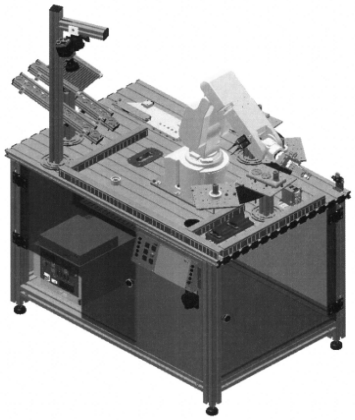

Figure 4. *Robot assembly station [4]*

Once desk set is to be assembled, the requiered paletts, comtaining the necessary components, are requested for placement onto the palette receptions [4, 5].

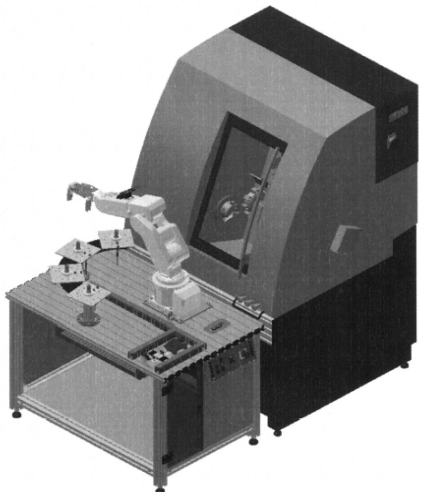

Figure 5. *CNC feeding Turn [4]*

CNC feeding turn

The CNC feeding turn (fig. 5) is responsible to production of single parts. The robot takes the raw parts from the magazines to equip the turn machine. There the workpieces are processed coresponding to their order. Before the workpiece is coming on the conveyor systems, the processed workpieces made available on pallets.[4, 5]

CNC feeding mill

The CNC feeding mill (fig. 6) is responsible to production of single parts. The robot takes the raw parts from the magazines to equip the milling machine. There the workpieces are processed corespondin to their order. Before the workpiece are coming on the conveyor systems, the processed workpieces made available on pallets.[4, 5]

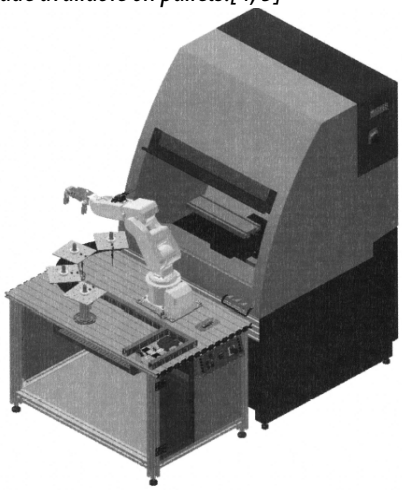

Figure 6. *CNC feeding Mill [4]*

AS/RS station

The AS-RS station (fig. 7.) has the function to provide and store the work-pieces and various paletts.[5]

Figure 7. *AS/RS station [4]*

Steps for implementation of drawingless manufactoring

For smart implementation of the drawingless manufacturing are there necessary to take some steps. These steps are presented below. In this paper is also presented the usage of the PMI information. This PMI information is necessary during the implementation of the drawingless manufacturing. Therefore we presents the smart way of its usage.

First step will be the analysis of the current state of drawingless production software package suitable for production in drawingless environments. The second step will be the creation of a general methodology for implementing drawingless production into FMS. The

next step will be the specification of measures necessary for the implementation of drawingless production in FMS. The last step is the verification and application of established methodology and set the drawingless production into the environment of iCIM system.[3]

We have to in frame of this implementation to prepare analysis of the state of art in field of the drawingless manufacturing. This analysis will focus to necessary hardware and software resources such an organizationally and technical requests for application. On the base of this analysis we will be to create general methodology for application of drawingless manufacturing to the practice. This methodology will be used in the conditions of the flexible manufacturing environment on our institute iCIM3000 presented before.[3]

Use of PMI information

Simple elimination of the risks and the ability to utilize all the information is to concentrate all the information concerning the product in a single source, which should be in my opinion, 3D model of the components. Nowadays the way to set possible manufacturing information into a 3D model, offers use of the PMI, or Product & Manufacturing Information. Possibility of creating PMI information now offer all major CAD systems and PMI information is gradually becoming part of the ISO and ASME standards (ISO 1101:2004, ASME Y14.41-2003).[1, 2]

The aim of the use of PMI is the transfer of a complete set of information necessary to produce the component directly into the 3D model. This information has to be then used in all downstream processes such as CAM, CAE, tolerance analysis, creation of brochures and other visualizations, etc. Finally, the PMI have to use the information to communicate with a supplier or customer in the form of so-called drawingless documentation.[1, 2]

PMI information must to be created and managed using a single module PMI. Tools for creating PMI information provides a comprehensive description of how to use the 3D model itself PMI size dimensions, which can add the necessary dimensional tolerances, and using geometric tolerances of form and position. Other area used to describe a 3D model with information, are PMI manufacturing information such as surface quality, or welding. Among the tools PMI must also find a wide range of tools to create notes that are otherwise shown on the drawings. Finally, the PMI module have to offer tools for creating 3D models of sections or slices that will allow a detailed description of the product.

Important features of all such generated PMI have to be the associativity of generated information of the objects on which the PMI information is created, so it is possible, for example one mark of quality like finishing assign the entire set of surfaces to be machined with the same quality. At the same time, must to be the logic of the individual instruments controlling derived from the tools, for the creating same information that are on the drawing, which makes the transition from 2D to 3D environment much easier.

Penetration of 3d model with PMI information

3D model have to carry the PMI information, serves as a document of controlled documentation, which is managed by the PLM system, providing full data management and control. Approval Data PLM system must be provided through a defined process so that it have to be traceable in every moment when is something happening with that document and what is his actually status.3D model through containing PMI information have to be the only bearer of comprehensive information about the shape, dimensions and manufacturing requirements of a product among all actors across its life cycle.

Communication of PMI data

The only reason why the drawings through the development process still created is its necessity for communication across the development process. This communication, however, today, in the electronic age becomes slow, error - simply out-dated. This chapter should focus on sharing electronic form PMI information between different actors in the development cycle.

It will start with the simplest model of communication, between the entities. These already have their work available to the appropriate imaging tools. These are CAD systems or other DMU systems - Digital Mock-up. These entities have the ability to share information with the support of PMI's own information system format, or PMI have the opportunity to share information via universal formats, such as JT, or STEP (AP242).

It may be a discrete entity that shares the mere discrete data, or it may be a cooperating entity based on controlled database of data.

Other problem is the shearing data with the subcontractors or partners who do not have access to the database, they are dependent on sharing discrete data, they nor have the tools to enable them to collaborate on the basis of information sharing PMI. Even in this case, now there is a very effective way of sharing data in the form of DMU browsers those companies such as Siemens provides free. These are for example browsers as browser JT2Go designed generally for any data in the JT format and viewer Xpress Review, intended for SW NX and Solid Edge development laboratories of Siemens.

The possibility of sharing data including PMI information is now only a matter of wanting to get away from, in my opinion, the obsolete model sharing information using drawings and embark on a new phase of electronic data sharing.

With the current state of computer technology, we are able not only to share this data, but also thanks to PLM systems to manage and control, which is fully completed the process refunds 2D documentation for 3D documentation.[2,4]

The formation rate of PMI information

The formation rate of PMI information is one of the cons of using PMI information. The next step I will show some principles which can the work with PMI information make easier and achieve clearly faster formation, against the creation using combination of the model with the drawing.

The first principle is to simplify. This means it is not necessary at all to create the 3D model information, as in the drawing, but only those which are important for the production, respectively to achieve the desired quality of the components, i.e. only tolerated and check dimensions, geometric tolerances, notes, and other surface quality. Then the number of PMI information decrease.

The second principle is the formation of PMI information already in the actual construction. PMI information is possible (and recommended) already defined in the design work, when designer has already had a clear idea of what requirements must be designed product accomplish. This enables to capture the information immediately at the time of the request. This prevents the complex procedure of inventing and re-thinking all dependencies when creating drawings.

The third method is the conversion of existing parameters. Acceleration of opportunities arises from the conversion of the existing parameters of the components. For example in system NX I will mark only the parameters that I want to convert then with the help of the context menu I will create the PMI information only from chosen parameters.

CONCLUSION

The aim of this paper is the description of iCIM3000 system, which is situated on our institute, and the further drawingless production methodology steps for its implementation.Categorization of these machines, which are presented in this paper, is the first step in the process.

The possibility of sharing data including PMI information is now only a matter of wanting to get away from, in my opinion, the obsolete model sharing information using drawings and embark on a new phase of electronic data sharing.

With the current state of computer technology, we are able not only to share this data, but also thanks to PLM systems to manage and control, which is fully completed by the process refunds 2D documentation for 3D documentation.

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