Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
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Annals of DAAAM International

FLEXIBILITY APPROACH TO EFFECTIVENESS INCREASING OF ASSEMBLY CELL

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Abstract: *Flexible manufacturing cell is manufacturing system consists of several NC machines. They are dedicated for correct workpieces group with similar operations series or for concrete type of operations. Characteristic feature of cell is mutual material and information connecting between machines. According to manufacturing process, the manufacturing assembly cell is possible to divide to three subsystems: technological, operating, controlling. By potential modification of flexible assembly cell configuration of elements according to determinate material flow is possible to increase its effectiveness. In modifications of configurations is necessary to ensure: observance of asked volume of manufacturing, achieving of balanced cycle of all operations, minimisation of costs for space and energy, minimisation of manufacturing and assembly process operations, optimum automation of manufacturing system.*
Key words: *intelligence, assembly cell, flexibility, automation, designing*

1. INTRODUCTION

Cell production became one of the most important studies of production spatial arrangement in the last days. These studies consists a lot of methods based on the researching of relation between workpieces – cell that assure production of multiform workpieces in small number in batch. Cell structures assure connection between machines, saved time and area, too. Machine operations are synchronized, material flow is fluent (workpiece movings from machine to machine are for the short distance). Manufacturing cells connected and take many of advantages of other production kind.

2. MANUFACTURING – ASSEMBLY CELL

Conception of integrated flexible manufacturing-assembly cell dedicated for small batch production system that manipulates with workpieces and produce from semiproducts individual parts for concrete final products. Parts are assembled to final product too. Unlike standard production system in this system the final product are produced and assembled in their workspace mainly from parts produced in this system, eventually from normalised parts. For manipulation and assembly in this system is not used external industrial robot. Exchange grippers for manipulation and assembly are installed on end effectors - vertical axis of system parallel with spindle. (Charbulova et al., 2009) Realisation and using this conception projected like flexible production - assembly cell brings smaller occupied place, smaller expense, and higher ratio of production device usefulness. **Błąd! Nie można odnaleźć źródła odwołania.**

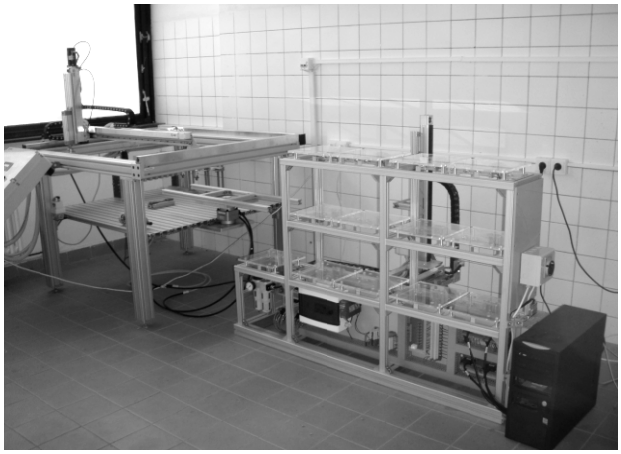

Fig. 1. Manufacturing - assembly cell in Institute of Production Systems and Applied Mechanics

3. PROJECT OF MANUFACTURING CELL

Costs for the manufacturing cell project are higher than in standard spatial arrangement. Structure conception needs resolution of difficult problems mainly choosing of similar workpieces to groups and spatial arrangements configuration of manufacturing technics. Conditions for resolution of these aims are not strictly defined to this moment. More of resolution tasks are directed to cell size, to her hardware and to material and information connections.

Particular cell elements like machines, robots and others is possible to defined and everywhere possible to buy but they are not guaranteed the effective action of cell.

Although cell effectiveness depends on these elements, mainly depends on their connecting, on the software and on mutual relations. Designs of manufacturing cells are not uniform to resolve complex tasks with limited sources, or to get around the tight places and etc.

Achieving a degree of integration characteristic of high-level automation level of manufacturing cell requires resolution of complex problems to product profiles spatially-cluster structural features and technology. Designing of flexible manufacturing cells is one task of macrodesigning.

Macro designing has 3 stages:

- a grouping of data design and technological characteristics of the production system designing,
- grouping planning and organizational characteristics of components,
- the synthesis parameters of the first two stages. (Pechacek & Javorova, 2009)

3.1 Flexibility of manufacturing - assembly cell

Flexible manufacturing cell is the most flexible of these production systems, using a minimum one and a maximum of three machines. It consists of technological device controlling programmed with the means of automation of technological

process, which operates autonomously. There are implemented various cycles with the possibility of connecting the system to a higher level. Automation means are workpiece containers with technological pallets, clamping devices, device for tool changing, device of waste removal and diagnosis. (Holubek et al., 2009) Activity of cell production is called “workpiece - oriented” and has important influence to:

- layout of workstations,
- material security,
- the organization of commercial work,
- work in process of material flow,
- material manipulation,
- production planning.

Basis of flexible manufacturing cell designing are:

- compilation of data and knowledge basis necessary for the production system and its detailed analysis, setting up a virtual model,
- establishment of a constructive model - detailed design,
- implementation on real production area.**Błąd! Nie można odnaleźć źródła odwołania.**

For the simulation of the proposed spatial arrangement is possible to use the Witness simulation software. This allows us to verify graphic design of the simulation model generated during the simulation run.**Błąd! Nie można odnaleźć źródła odwołania.**

- There can be seen fe. actual occupancy of buffers stores, using of equipment and some graphics elements that clearly serve to streamlining proposal. (“pie” charts, usage of different devices, a list of parts, machines, operations).
- The principle of simulation is simple - instead we follow the dynamic behavior of a process that interests us and his reaction to organizational and made technical changes, we monitor the behavior of the model. Such modelling can be an object such as the production line, system of full maintenance, storage of wholesales trade and flow of information. This way of working brings many advantages - we can create models and even non-existent systems designed right from the first system that its behavior corresponds exactly to our wishes. The simulation time can operate faster than real and it is possible to quickly evaluate different variants of the proposed problem solutions.
- Witness can be used to analyze any process where it is necessary to measure the impact of proposed changes and to quantify solutions alternatives. (Vazan, 2006)
- In any given time we can stop the simulation, change the parameters of the system, such as storage size, number of workers or material direction and then continue in the simulation again. Once we follow the consequences of these changes. Witness offers great flexibility in scope and focus of the simulation objects.

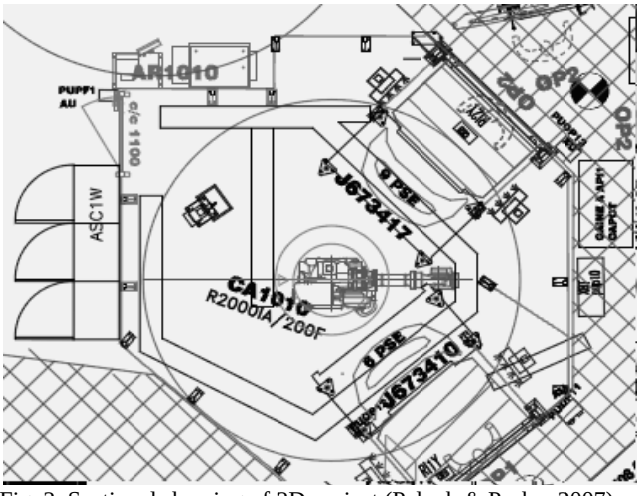

Fig. 2. Sectional showing of 2D project (Paluch & Pesko, 2007)

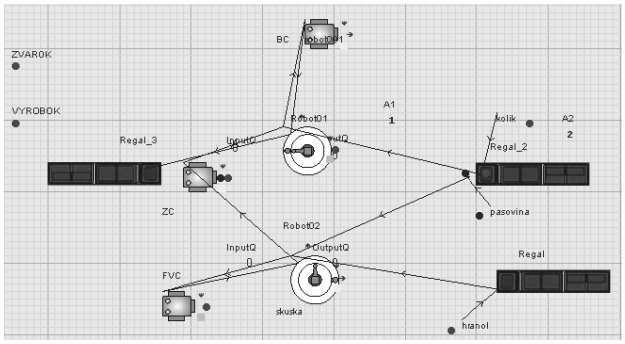

Fig. 3. Final showing of FMC simulation in Institute of Production Systems and Applied Mechanics

4. CONCLUSION

In automating the manufacturing process is closely linked and simulation and modeling methods. Modeling of the technological process is the process, altering the properties of real object on the formal description. Description has different forms depending on what class the object model as a formal description of the apparatus to be used as the object's properties will describe the model for what purpose will serve. When the model is created then simulation can be used. Simulation means experimentation with computer models of real production system, in order to optimize the production process.

For many of the world's most successful automobile manufacturers and their suppliers is a result rather than realized. Simulation surely brings additional, measurable benefits - increased confidence in the proposed solutions to reduce the risk in the decision, better communication within the work teams leading to faster acceptance of the proposed changes and the like. One of the strengths of Witness is his flexibility. By program can model virtually any manufacturing, logistics or attendants process.

5. ACKNOWLEDGEMENT

This paper was created thanks to national project VEGA 1/0206/09 Intelligent assembly cell.

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