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PLANNING AND DESIGN PRODUCTION SYSTEM ORGANIZATIONAL STRUCTURES AND PROCEDURES

Štefan HORVÁTH, Angela JAVOROVÁ

Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava, Institute of Production Systems and Applied Mechanics, Trnava, SLOVAKIA

ABSTRACT:
Regardless of company size, industry and type of production, each firm must strive for optimum utilization of its productive resources. There is a large amount of information in production systems, which in proper treatment helps to their optimal use in planning, designing organizational structures and procedures. The integration of information technology (IT) in engineering technology to collect and process information and render more effective to the extent that it can speak of a certain level of use of "artificial intelligence" in the manufacturing sector.
KEYWORDS: Planning, design, expert system, production system

1. INTRODUCTION

Already the first results from the world, but also Slovak companies at the end of the first half of 2009, the observer may notice that the turnover year on year decrease is not directly proportional to the decline in profits. Companies increasingly begins reduce their resources, labor force and adjust their production to current demand at this time. On the one hand, the companies currently reduce its resources. On the other hand, most international companies focus on the development. The development is meant to improve efficiency the preparation of their production or develop new products.

The cleverest and most effective solution how to reducing their resources or upgrading can be done using information technology (IT). Nowadays mechanical engineering is influenced largely the IT. Integrating IT into the modern organizational structures and manufacturing technologies have to deal with businesses that want to remain competitive. [3]

The integration of engineering and information technology has been a powerful tool for CIM (Computer Integrated Manufacturing). This article deals with optimizing the utilization of manufacturing systems using the CIM elements and by recent scientific discipline "artificial intelligence". Artificial intelligence gradually found its place in certain sectors of production where it helps the solution of complicated tasks.

2. PRODUCTION PLANNING AND CONTROL

CIM can be understood as a concept, philosophy, organizing principle, a specific methodology and manufacturing system - it depends of the elements of this concept is used. Thus becomes a key tool for future business strategies. The planning and management of production-assembly systems is the concept of using so-called PPS system (Produktion Planning and Scheduling). It is one of the most effective ways of planning and proposal production management. This system is useful in creating new, also the analysis of the existing production system and its subsequent optimization.

With the PSP system can design the whole production. The primary task is to formulate the production planning system (positioning of machines, conveyors, central stores, local stores, tanks - the determination of their capacity, finding the necessary amount of labor and everything regarding the structure of production). Self-management of production is managed and controlled events (processes) in the production system. Production system must be responsive for all possible events (effects) that may occur. There are certain boundaries in planning, but also in production managing. These limits can be given in terms of the production system structure or individual characteristics affecting production or logistics. It may seem that the system is intelligent. The control system only responds to the impacts of the production system.

3. ARTIFICIAL INTELLIGENCE IN MANUFACTURING SYSTEMS

Production systems and flexible manufacturing systems are known for decades. They are great importance in small and medium series production. Each production system is unique. They are designed for different types of products. Most firms produce only one product, but with several modifications. Production systems are being improved by new technologies, techniques, materials and so on. Perhaps there is the question of why science pulls the new discipline of "artificial intelligence" to an area that works reliably for decades. The answer is to streamline the production (better utilization of machines, reduce the time, the entire production system). In the literature we read about several ways to use "artificial intelligence". This article describes a method and expert systems in planning, designing organizational structures and procedures.

4. SUPPORTING CREATION LEVELS OF A MODEL PRODUCTION SYSTEM

Preparation of such a model is very complex and lengthy process, which involves a large number of experts. [7] Modeling and subsequent production system can be divided into the following stages (levels):

1. level: Planning Process
2. level: production planning
3. level: production management

4.1. Planning Process

Characteristics of products represent a key role at the first level (geometric, material). Another important factor is the type used in production technology, which is also dependent on the type of production. Technological processes are developed and optimized at this level. Programs for production machines are made on the basis of established technological procedures. Input parameters to the first level of the model (product) derived from the concept of CAD (Computer Aided Design). The technology will be determined based on model and type of production (piece, serial, bulk) of the parts. Technology procedures alternatives are drafted in the second level (type of machine, their numbers, equipment, etc.) another input parameter for orders. The plans of the production orders are generated in this agenda. The plan is meant the grouping of contracts under certain criteria (delivery time, date of issue, quantity, etc.) to determine the material consumption and performance for the whole plan, that all contracts in the plan together. Then journey processing (manufacturing, assembly) will be determined on the basis of this level and their input parameters. Of these programs to individual machines and supporting the production will be created. A very important parameter of the prominent levels is the times (time study). Major and minor times required to produce a product for individual jobs (machines). The technological process if given the alternatives it is necessary to establish the time of the study. Time data can be obtained three ways:

- Calculations - complicated and usually inspects many factors
- Experiment - time consuming, but better than the first method,
- Simulation - the integration of IT into the convenience of engineering technology.

Last way - simulation is suitable for designing a new manufacturing system. A virtual manufacturing system is created in the design phase.

Modern software packages can no longer credibly simulate a large number of technologies (eg printed-forming process, bulk hauling, machining, assembly, injection modeling, casting, melt welding, etc.). [1], [6] It is possible to determine the time data to produce individual work to machines used in precision machine-defined.

4.2. Production planning

The production plan is drawn up in the second level of the input information (orders, the number of units, start date, date of execution, inventory, status of resources, occupancy manufacturing plant, operating times, etc.). Production planning provides a range of the production orders to be released, that means, enter into production (produce) and ensure their futures for the layout of the available production equipment. The process is based on customer orders to be made during a specified period of time in the production system. Agenda associates (accumulates) the individual production orders in a joint plan to merge these contracts. Items of the plan will be calculated after adding the plan to the contracts as the sum of all items of production orders. Items can be combined plan for mass production - the same item count and produce together without division of the contract.

The need for material items is calculated from the plan. They are compiled exit of material, calculates the consumption and monitor production. The information needed to create a production plan to accumulate at this level.

4.2.1. The creating production plan issue

The management process starts with planning, which is its most important function. Start any business is to plan how to achieve a result. The planning process involves all the decisions that determine future activities and results, as well as appropriate measures for implementing these activities and results. The plan consists of the following elements: purpose, resources, action and implementation. Every company should plan its activities, regardless of company size, industry and type of production. Companies usually make short-term (operational) plans, which include a period of time (eg, the so-called annual business plans). The main entity to production plan create are orders, that determine the product type and number. And they usually determine the earliest start time and latest end production.

The production process consists of one or several consecutive operations, which require some time to carry out operations. Only one operation can be performed on one product at a certain place at the same time. The operation can be performed manually or by machine. Suspension of operations is inaccessible.

The same operation can be realized simultaneously in one place for one or more components in a specified number. Components can be collected between machines in the magazine with respect to their defined capacity.

The plan is to ensure that all production operations are realized in the time and sequence of machines for production, taking into account the necessary resources (tools, components, products, etc.). The result will be realization of all orders on time and use the whole production system is most optimal. These four categories of information should be taken into account except the time trials:

$$S = (J, O, M, F)$$

$$J = (J_p, n)$$

J_p – characterized by a product
n – number of product

The main features of the products:

- Are all products (orders) equivalent, there are priorities among the various products?
- Arrive products dynamically, or each time a product is defined?
- Are there any sequence of the products it describes oriented graph $G = (V, E)$?
- Exists start and end date product manufacture?
- There is provision in the contracts, which determines the size of production batch in terms of production and logistics? [5]

$$O = (O_p, K_m)$$

O_p – describes the operation
K_m – indicates the maximum number of operations to the product

The main features of the operation:

- Are operating times deterministic or stochastic?
- If the oriented graph *Go* (*V, E*) describes the sequence of products, thus there are attributable to the order of alternatives.
- Are operations feasible only for a particular place (machine) or any other relevant alternatives? (eg, parallel machines)
- Are there feasible alternative technological methods in the monitoring of production systems
- Is it possible to return to the machine, which has already been carried out earlier operations?
- Is it possible varying the intensity of operations? If so to what extent?
- Are there machines performing alignment or distribution of products?
- Are there technological regulations which would determine the size of the lot?
- Is it necessary to set time machine before work?

$$M = (M_p, M_j)$$

M_p – working machines describes
M_j – indicates the number of identical machines

The main features of the working machines:

- Is it possible to put into one group equivalent machines, which are also substitutable? What are the criteria for equivalence? (costs, production intensity, the ratio of rejects)
- Are there multi-purpose machines, which are able to perform several successive operations on the product without interruption?
- The machine is operating or needed accessories for (instrument, tentacle, plant, NC program, etc.). To perform that operation?
- Machine capacity is constant or depends on the marking a calendar.
- If setuptime is dependent on the machine, so depending on what requirements?
- Magazines between working machines have a limited or unlimited capacity?

- What are the logistics of production rules between doses?
- Posts are available deterministic or stochastically?
- There are machines performing assembly or disassembly operations? [5]

$$F = (F_p, F_f)$$

This element is characterized by production targets, the type of company policy.

Main features:

- Delivery of goods is determined or not?
- How can dynamically increase the capacity for a specified delivery date?
- What is the average time of delivery of goods?
- What is the average required storage capacity?
- What should be the average utilization of machines?

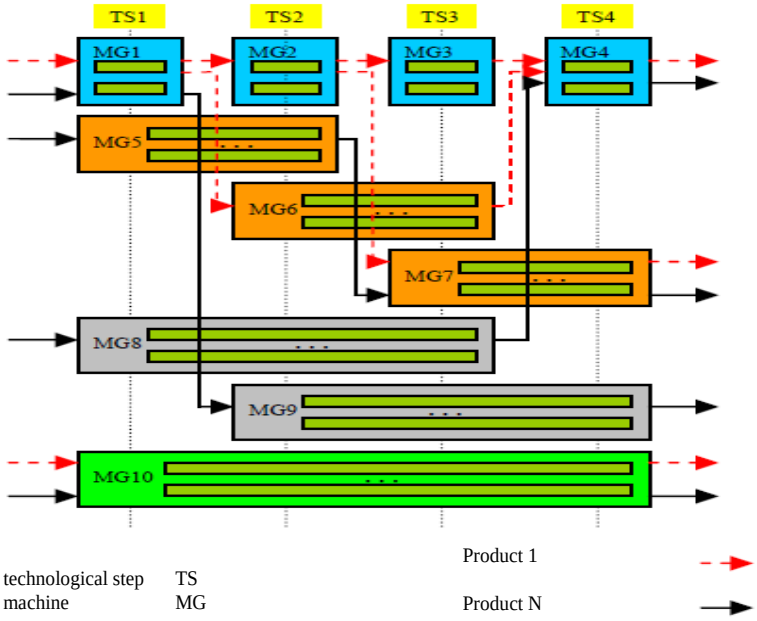

Fig. 1. Model of flexible manufacturing system [4]

The previous section makes it clear that production planning is a complex task that requires a huge amount of information processed. Existing expert systems for planning, designing organizational structures and processes in production systems offer the basic structure of software designed for just this task. Therefore, experts devoted to this problem must be well familiar with the manufacturing system by going to integrate the expert system. They have largely created the model will help in PPS system, which can easily obtain the necessary information on the production system.

4.3. Production control

Production control - builds on the role of production planning and coordinating the interaction of the basic elements of the production process so as to meet the requirements of production planning.

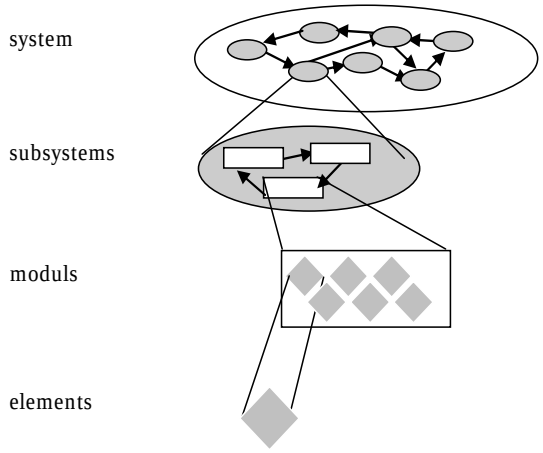

Fig. 2. Manufacturing system levels

It coordinates the interaction of main and auxiliary processes. Production control requires updated information in real time during the actual manufacturing process (feedback from the manufacturing process) and evidence from production planning. Resulting in the production of information is collected at the third level, there are evaluated and on the basis of this assessment control system take appropriate action. The complexity of managing control systems is characterized by its particular structure, relationships between system elements and surroundings. The collection, processing and distribution of information about the area, which had been an important place in traditional production systems, are of increasing importance in automated manufacturing. Each production system is unique, but he characterized the level.

There are four levels of control in such production systems:

- production control system,
- production control subsystem (cell),
- control of individual machines in a cell,
- process control.

5. CONCLUSION

This article highlights the need to use modern technological achievements in the design, planning and optimization of material flow through the use of PPS systems and artificial intelligence. This paper was created thanks to the national grant VEGA 1/0206/09 intelligent assembly cell, which deals with the development of an intelligent system. One of the possibilities of artificial intelligence systems in assembly planning is designing organizational structures and procedures. For this reason it is recommended good knowledge of production systems and subsystems and their relationships between them. The easiest and most economical way of obtaining such knowledge is the use of programs designed to simulate material flow in production.

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