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APPLICATION OF INTELLIGENT MANUFACTURING SYSTEM IN THE FLEXIBLE ASSEMBLY CELL

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ABSTRACT:
Productivity, reliability and quality of parts can be improved by mechanization, automation and computer support to engineering production. Automation of engineering production is a basis for production intensification and flexible response to customers' requirements. Current general trends in engineering production include integration, flexibility and mainly intelligence. That is mainly intelligent manufacturing systems in the locality of intelligence.
This contribution deals with manufacturing systems of new generation in automated manufacturing and that is intelligent manufacturing system.
KEYWORDS:
subsystems, process, automated, intelligence, generation, production

1. INTRODUCTION

Ultimate demand of manufacture improving is increasing of its competitiveness. On world market we know competition from increasing of product amount growth, product diversification and from technological and organizational innovations. Increase of competitiveness is possible to achieve through the innovations and product quality raising, shortening of delivery date and decreasing of production costs, but mainly through the permanent developing of automation of manufacture process.

Continually innovations, modernization and developing of automation of manufacturing systems is relative to demands of technological processes, specialization of its manufacturing and to pressure on decreasing of production costs. Consequently, raising of demands to product quality are claimed. As the developing of automation is constantly progressing is effective to talk about creation and possible application of new generation flexible manufacturing systems – intelligent manufacturing systems. Principle aim and demand of creation and application of intelligent manufacturing systems is increasing efficiency of manufacturing process, shortening of production and incidental times, massive decreasing of production costs and especially exclusion of man in production process. Man's activity in IMS should be limited just to control computer operating.

2. INTELLIGENT SYSTEM

In characteristics and creation of basic definition of intelligent manufacturing system, is necessary to come out of basic terms of machining intelligence

(intelligence is there known in term of technology) and flexible manufacturing systems.

Come out of analysis of terms intelligent system and intelligent technology. Intelligent system is such a system, which consists of machining intelligence elements.

Among basic properties of systems with machining intelligence elements belong following properties and abilities:

- system ability to learn of data and obtain new knowledge,
- system ability to save obtained language,
- to utilize obtained knowledge in solution of specific situation (14).

Existing properties would belong to main abilities of IMS. Intelligence is in many cases known as control of program product and not as implementing of modern technology and machining intelligence elements.

3. INTELLIGENT MANUFACTURING SYSTEM – IMS

Basic definition of IMS is:

Intelligent manufacturing system presents system with autonomous ability to adapt to unexpected changes, i.e. change of assortment, market requests, technology changes, social needs etc.

In specific type of construction of IMS should be cared about following requests:

- low production costs,
- universality, adaptation of production system to specific product,
- precision and high quality of manufactured products,
- expressive shortening of main and incidental production times,
- exclusion of man in production process,
- safety.

With growth of requirements to manufacturing systems, come other criteria, which would widen abilities of manufacturing system. Requirements can be defined by changing character of production.

Goal is to create such a system, which is capable to react flexible to various situation in production process:

- to change of shape of manufactured product,
- change of measurement properties of product,
- packing of subsystems with components,
- unexpected switch to different type of products,
- time variation in production process,
- change of technological parameters,
- securing against crash situations.

Further is possible to define IMS as follows:

Intelligent manufacturing system is possible to consider as higher phase of flexible manufacturing systems. Intelligent manufacturing systems like flexible manufacturing systems consist of individual subsystems (technological, transportation and handling, control, store and operative). Each subsystem has to contain of intelligence elements, which give to these subsystem certain degree of intelligence.

To the basic elements of machining intelligence belong visualization of production process (monitoring), which enables to observe own status of system and changing conditions of environment.

Primary information for realization of production tasks in required order, come in to the operative system of IMS over basic elements of machining intelligence – over sensorial elements, which expressively increase degree of intelligence of manufacturing system.

4. FLEXIBLE MANUFACTURING-ASSEMBLY CELL ON THE DEPARTMENT OF TECHNOLOGICAL DEVICES AND SYSTEMS

On the Department of technological devices and systems flexible manufacturing-assembly cell is under construction. There will be five integrated production stages:

- Storage of semiproducts and its transportation to production device,
- Machining of semiproducts to final products,
- Handling of individual components,
- Assembly of individual components to final product,
- Handling of final product and its storage before expedition.

Each stage will be independent to others. Device consists of several components

Rack interpolator

Rack interpolator will be used for storage of semiproducts, individual components and final products.

Portal 3-axes SMC – robot

On picture 1a portal robot is shown and on picture 1b is workspace of robot.

Figure 1A. Portal 3-Axes Smc – Robot

Figure1B. Workplace Of Robot

Workspace of SMC portal robot consists of several components. On the vertical axis of robot is stepped AHC unit, which is attached to pneumatic linear cylinder. Cylinder is secured against rotation by hexagonal rod. AHC unit is system for automatic change of tentacles. Tentacles are stepped in stands, which are fixed to worktable.

On picture 2a AHC unit is shown – system for automatic change of tentacles. On picture 2b is possible to see stepping of tentacle in the stand on robot's worktable.

Figure 2A. Portal 3-axes Smc – robot

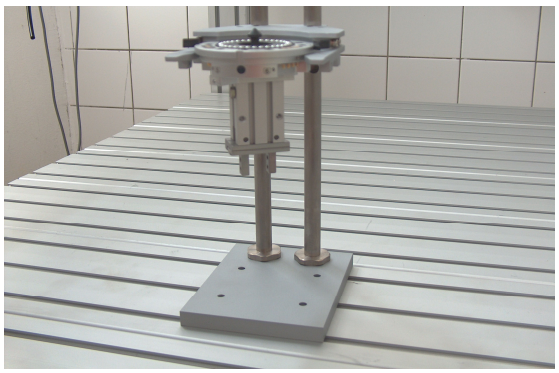

Figure 2B. Workplace of robot

Individual tentacles are equipped by various jaws, which are made in various shapes and sizes. Tentacles are stepped in stand, which will be fixed to worktable as well. Jaws in container are properly oriented and equipped with sensors. On the vertical axis is moving unit in which is stepped the drilling machine. Tools are picked up in dependence on technological operation. Various shapes of drills, shank mills and grinding elements are in the tool container.

On picture 3 is possible to see the tool container on robot's worktable.

Figure 3. The tool cotainer on robots worktable

Operating of whole system is realized by control computer, which is due to operate whole system so that no crash situation should occur. Pneumatic distribution is attached to whole system. It's necessary to operate AHC unit and pneumatic clamp, which has electro-pneumatic valves required to operate the clamp's jaws.

Main goal of the grant task VEGA 1/3193/06 – "Multifunctional manufacturing and assembly cell", is to compare properties of MS, FMS and IMS, specify differences between the systems and integrate the knowledge to MS designing. Identification of individual properties of intelligent system and differences between them will be applied to flexible manufacturing cell on Department of technological devices and systems. Ahead of the application will be:

- Selection of components group, which will be made by the cell.
- Analysis of requirements of MS, FMS and IMS for definite components group.
- Define of precise parameters, which should be part of IMS, FMS and MS.
- Define individual intelligence elements for intelligent manufacturing cell.
- Design and possible implementation of chosen intelligent production procedures in flexible manufacturing cell.
- Working out of production algorithms for definite components group.
- Define and identify exact differences between MS, FMS and IMS.

In this contribution is processing analyze of impositions for IMS, FMS and MS and define of precise parameters, which should be part of IMS, FMS and MS.

In following contributions will solution listed items according grant task VEGA 1/3193/06- Multifunctional manufacturing and assembly cell.

5. THE CONCLUSION

In recent years the manufacturers have invested most to the beginning a end of the production process. To the designing stage by introducing of CA systems and to production stage by modernization of production. CA systems became standard by majority of manufactures, therefore if they still want to increase competitiveness, they have to increase efficiency, productivity and quality of production.

This is main reason that technologically advanced countries focus on preparation and realization of modern manufacturing systems, mainly new

generation systems – intelligent manufacturing systems, through which would achieve elimination of human service out of production process. Man's activity in IMS should be limited just to control computer operating.

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