

## SELF ORGANIZING MANUFACTURING CELL PHILOSOPHY

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**Abstract:** *Philosophy of flexible manufacturing cell dedicated for small batch production present production system that manipulates with workpieces and produce from semi products individual parts for concrete final products. Parts are assembled to final products 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 normalized parts. For manipulation and assembly in this system is used industrial robot which is the base of whole manufacturing cell. Exchange grippers for manipulation, machining and assembly are installed on vertical axis. Realization and using this conception projected like flexible production - assembly cell brings smaller occupied place, smaller expense, higher ratio of production device uses.*

**Key words:** *flexible manufacturing, industrial robot, assembly, machining, end effector*

### 1. INTRODUCTION

The production strategy in the second half of 20<sup>th</sup> centuries was characterized by effective using of dedicated machines and automated lines. The goal was to achieve a maximal volume of production. The small shortening of production cycle has significant effect to production volume in mass production.

Before 70<sup>th</sup> years of last centuries the mass production responded to basic requirements of market, but after this got started consumer affected the market. The producer must adapt to consumers requests and get started production of some variants of its products. This changeover has significant impact to mass production. Producers who can produce the wide range variants of its product have domination at market.

This trend in production continues to present time. Today market is characterized by strategy of consumers individualization. This strategy is oriented to consumers requests. Consumers want new products and time has fundamental task to its satisfaction. The production was broadened, innovation cycle is shortened, the products have new shape, material and functions. At this strategy the traditional understanding of costs lost in importance. Most important is a time and improving is its shortening. The production strategy focused to time need change from traditional functional production structure to production by flexible manufacturing cells and lines. Production by flexible cells (FMS) is a most important manufacturing philosophy in last years. This philosophy is based on similarity:

- similarity of manufactured parts,
- similarity of process plans.

Recognize the similarity of manufactured parts allow grouping them to groups by machines required to its manufacturing. By manufacturing of this group of parts we achieve economical effect near to mass production.

The manufacturing cell is an open manufacturing unit with transparent manufacturing processes. Flexible manufacturing cells represents today trend to manufacturing innovations and productivity increasing.

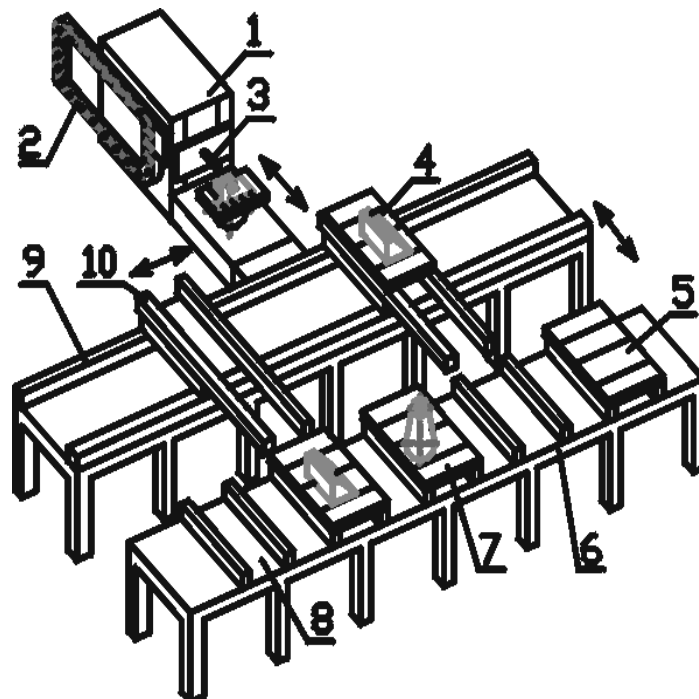
## 2. FLEXIBLE MANUFACTURING CELLS

The flexible manufacturing cells are characterized by high level of manufacturing proces automation. They are used mainly in middle batch production (500 – 2000 pieces of products) and for middle products range (5 – 100 types of products).

The supplementary devices are used mainly to manipulation with workpieces and tools:

- workpiece storage and device for workpiece changing,
- storage, controlling and changing of tools,
- quality control.

At Fig. 1 we can see manufacturing cell with one machining centre which working in large



**Fig. 1** Flexible manufacturing cell with one machining centre

*1- machining centre, 2- tool storage, 3- machining spindle, 4- palete with workpiece, 5- palete without workpiece, 6- palete storage, 7- palete with product, 8- free place in palete storage, 9- conveyor, 10- free conveyor holder*

batch mode (traditional method for manufacturing to higher volume of the same parts), or in flexible mode (manufacturing small volume of the same parts, but the several type of parts). Manipulation by workpieces and products are realized by pallets and conveyor.

### 3. NEW CONCEPTION OF MANUFACTURING CELL

Basic idea of this project is build device which will integrate 5 manufacturing phase for all products. These phase are fellow:

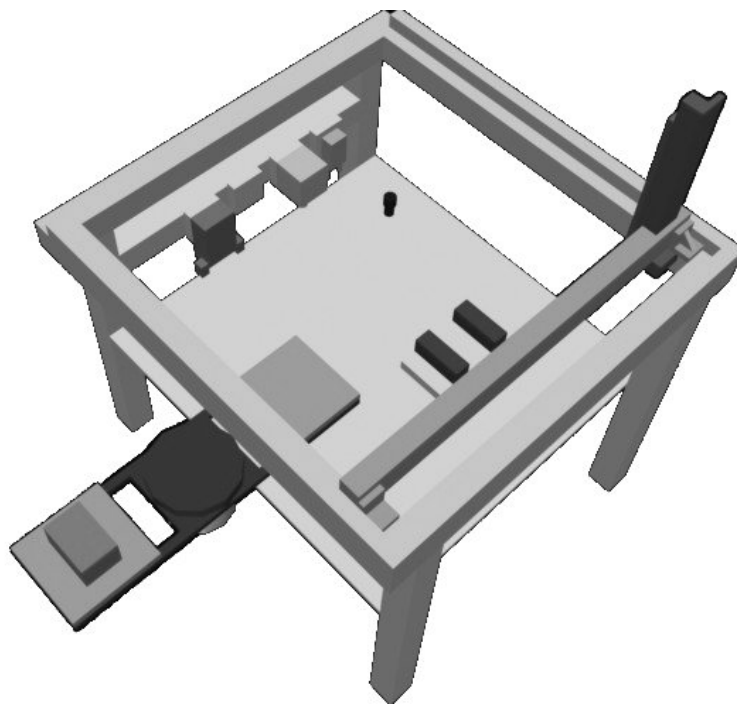
- semi product store and its transport to manufacturing device,
- machining of semi product and its quality control,
- manipulation by several parts,
- assembly the parts to final product,
- manipulation with final products and its send off to storage.

All of these phases will be solved independently but with respect to relations by other phases.

The device will contain 3 connected parts:

- shelf storage with manipulator,
- rotary feeding device,
- multi functional manufacturing device.

In base of this trend we introduce new non traditional model of integrated flexible manufacturing system for small batch production. This system doing manipulation with workpieces, machining its for concrete final product. These final products are assembled by this system and send off to storage. Base of this system is a portal construction with tree linear



**Fig. 2** CAD model of manufacturing cell

motions, which create cartesian workspace. This manufacturing system is supplemented by shelf storage with palette manipulator and rotary feeding device.

This conception of manufacturing system is different from the traditional system because it has only one workspace and in this workspace are realized all manipulation, machining and assembly operations without external industrial robots.

#### 4. CONCLUSION

The cell manufacturing became in last years one of the most important manufacturing types. This conception is based on the relation between manufacturing cell – workpiece. Flexible manufacturing cells allow manufacturing the small numbers of parts from a huge range of types and achieve good economical effects near by large batch or mass production. The manufacturing cells structure has connected the machines and saved the production time, space and production costs too. Functions of machines are coordinated and the material flow can be quick.

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