



AUTOMATIC STORAGE, TRANSPORT AND HANDLING IN FLEXIBLE MANUFACTURING SYSTEMS

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Abstract: *the flexible manufacturing system can be characterized by integrability, adequacy, adaptability, structural dynamism and are usually designed to efficiently process a small or medium volume of product families; the main condition is that the transfer of materials should always take place at the right place and time.*

the structure of the automated flexible manufacturing is realized through the logistic system, ensuring the correct distribution in space and at the necessary moments of materials.

Keywords: *flexible manufacturing system, CNC machine, automatic transport*

1. INTRODUCTION

It is considered that a flexible manufacturing system must be characterized by integrability, adequacy, adaptability, structural dynamism, presenting an optimal balance between universality and specialization that must be obtained by taking into consideration when designing the system, certain well-defined and analyzed manufacturing tasks, to identify the similarity and stability over time of the operations. Flexible manufacturing systems are usually designed to efficiently process a small or medium volume of product families; the flexibility being limited to their processing characteristics.

The flexible manufacturing system includes all the subsystems that are part of a manufacturing system (processing, logistics, control, order), but the concept of a flexible manufacturing system implies a complete integration and coordination of the four component subsystems through the computer. This fact requires the use of CNC machine, automatic conveyors, robots, manipulators, communications network that coordinates all the information flows which control all the flexible manufacturing system which are determining the automatic processing of parts, storage, transport and automatic handling, automatic control of all system components, automatic surveillance, control and diagnostics.

2. FLEXIBLE MANUFACTURING SYSTEMS

Storage, transport and handling refers to the automatic flow of materials into the flexible manufacturing system and includes:

- handling of parts, tools and devices in warehouses;
- collection and disposal of chips and cooling-lubricants used in the system.

The main condition in the operation of the storage and transport subsystem is that the transfer of materials should always take place at the right place and time.

Automatic manipulation is essential in the creation of a flexible manufacturing system, being executed by one or more industrial robots. Within a flexible manufacturing module, several automatic operations must be carried out, through which some of the partial functions of the machine tool are executed in the flexible manufacturing system.

Automatic handling is required for machine tool parts to be supplied, for:

- transfer of a pallet with the part fixed on the machine table. After processing, the part is transferred in the opposite direction, with help of the transport means;
- changing the position of the part on the pallet fixed on the machine's table, if the processing is done from several clamps;
- transfer of a revolution part from a parts store or from a transport pallet in the system of the machine and vice versa.

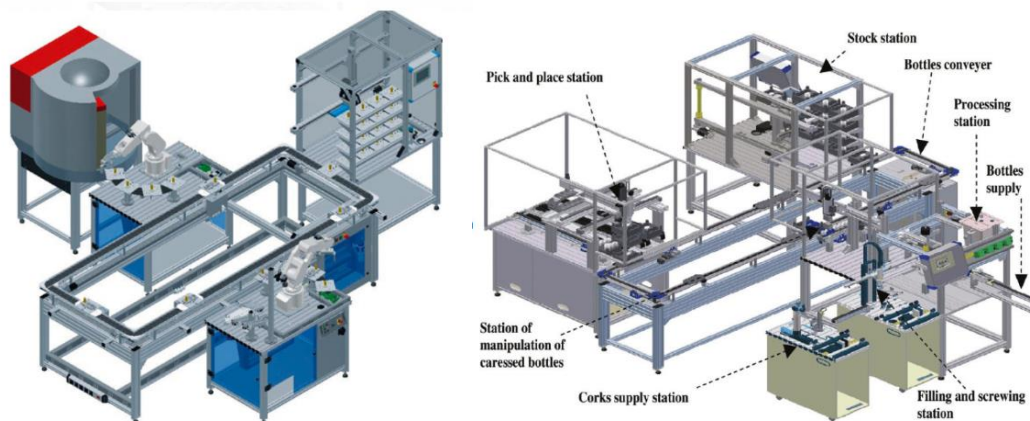


Figure1: Automatic handling

The tool handling involves the automatic transfer of the individual tools or groups of tools from the machine tool holders (manufacturing center) to the machine and vice-versa. The manipulation in case of fixing device or the robot/ manipulator prehensile, it can also refer to changing mandrels or their bins, changing the type of arm prehensor, etc. The control of the measuring and control devices is performed by special controllers, in case that the control of the part is done directly on the machine tool or if the "origin" is determined depending on the position of the part on the machine etc.

To achieve all of these, it is necessary both the existence of the "manipulator" and other facilities, such as machine tool holders: tools, parts, pallets, parts, devices, verification and control systems, in which tools, parts, etc., are positioned and oriented (warehouse type). In the absence of orientation, the systems are complicated, requiring more complex systems of tracking - such as visual sensors (cameras) and systems of image recognition.

In the structure of the automated flexible manufacturing, the automatic storage of the semi-finished goods, finished parts, tools, pallets, devices and auxiliary materials and the automatic transport, through the connection between the workstations of the flexible manufacturing system is realized through the logistic system, ensuring the correct distribution in space and at the necessary moments of materials. The storage and transportation of the flexible manufacturing system involves:

- coding of pallets, tools and devices for their purpose, for recognition, delivery and tracking;
- the actual storage of pallets, tool holders and other auxiliary materials;
- recognition (reading the code) of the pallet, tool from the tool holders, etc.;
- palletizing / de-palletizing parts and tools;
- delivery in the system of pallets, tools, shops;
- transport of pallets with semi-finished products from the warehouse to the machine tool in the system and between machines, as well as from the machine tool to the automatic control or washing stations;
- transport of pallets with finished parts to the warehouse of finished parts or to the depalletization station;
- transport of individual tools, multi-axial ends or tool holders;
- transport of empty pallets or other devices for centering / fixing parts;
- the transport of auxiliary materials such as chips or coolants - lubrication collected from the workstations.

A basic principle of organizing the storage and transport operations within the manufacturing system is the position preservation of the stored and transported object. The elements that allow to satisfy this requirement are the deposits, respectively the pallets.

The part warehouses within a processing system are intended for taking over and maintaining the reserve of semi-finished products, of parts with partial processing and of all finished parts, as well for delivering to the workstations of the semi-finished products and the parts that are partially processed. The warehouse of parts realizes the storage of the pieces, which depending on the situation, can be:

- storage for supply, made by warehouses for semi-finished goods;
- process storage, carried out by intermediate (interoperable) warehouses;
- delivery storage, made by warehouses for finished parts.

3. CONCLUSION

All the elements that are part of a flexible manufacturing system are linked in a unitary system thought an automatic transport of materials and tools, which ensures the distribution at the workstations, at certain times, of the parts, devices, working and measuring tools, etc. The technical means by which automatic transport is carried

out within the flexible manufacturing system can be very diverse, the diversity being determined both by the construction of the means of transport and by the shape of the trajectory or the position of this trajectory.

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