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Review of development and advancement in Flexible Manufacturing System

Ritvik Maliya[1], Rohan Gupta[2], Ak Madan[3]

[1]Student, Dept. of Mechanical Engineering, Delhi Technological University, Delhi
[2]Student, Dept. of Mechanical Engineering, Delhi Technological University, Delhi
[3]Associate professor, Dept. of Mechanical Engineering, Delhi Technological University, Delhi

A B S T R A C T

Flexible manufacturing system consists of Computer numeric Control (CNC) machine tools, interconnected by material handling and storage system. It has ability to change and adjust itself according to the market demands. FMS is really useful in industry but it is not enough to deal with modern problems. This leads to development of new technologies like Reconfigurable Manufacturing System (RMS). Its software and hardware are of modular structure. Different modules can be added, removed and switched according to the requirement. Implementation of AI can also be helpful to deal with many complicated processes in manufacturing. We can upload our data on a cloud and use this data to remove defected parts in future.

Keywords:Flexible Manufacturing System, Reconfigurable Manufacturing System.

1. INTRODUCTION

Flexible manufacturing system is manufacturing system with highly automated machine cells. It contains multiple interconnected workstations (CNC machines) by automated material handling and storage systems. All of these components are controlled by computer with the help of computer-controlled system.

Features of Flexible Manufacturing System

1. A Flexible Manufacturing System is different from an automated production line due to its ability to process different product style at once.
2. Flexible Manufacturing System gives us flexibility in changing production time in order to fulfil the demand of different products.
3. It has capability of producing large number of similar parts at low cost.
4. It can produce different part without major retooling.

2. COMPONENTS OF FMS

1) Workstations - They are CNC machine tools that performs different machining operations on the workpiece. First our workpiece reaches to the machining centers. Then it is loaded and unloaded to different Machine tools to perform different operations with the help of Load and Unload stations. After this all the parts are assembled and send to inspection stations.

2) Automated Material Handling and Storage system

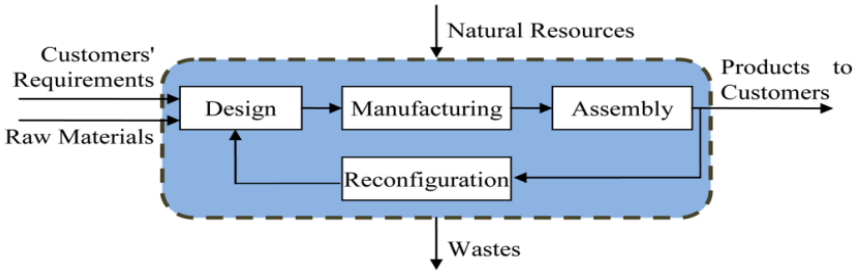
They are used to transport unfinished and unassembled parts between the processing stations and storage system. The parts can be moved randomly and independently between the work stations and can also be stored temporarily in the storage system.

3) Computer Control System

It helps in controlling all the components of FMS like workstations and the material handling system. It can also control the system performance and can report it to the users.

3. RECONFIGURABLE MANUFACTURING SYSTEM

Rms was developed by the university of michigan college of engineering's research centre. A reconfigurable manufacturing system (rms) is a system used by manufacturers that emphasizes the importance of being able to change rapidly in short time. It can change its productivity capacity and functionality according to the changes in market demand. Rms has a modular structure in software and hardware. We can add, remove and switch these modules to make the changes in our system. Due to a sudden change in the market, the fms are forced to change their production to mass production that affects the optimization of the inventory but the reconfigurable manufacturing system changes in response, allowing the company to produce goods or products in an efficient manner.



4. CHARACTERISTIC OF RMS

1) modularity – machines, tools and other items in rms are present in modules. They can be integrated, removed and switched according to the requirement.

2) integrability – different modules can be integrated in an rms at both machine and system levels.

3) customization - rms is flexible enough to upgrade and add new modules.

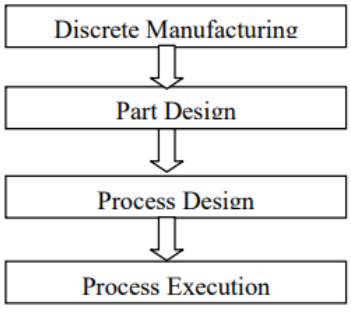
4) scalability – rms can rearrange itself to add new products.

5) convertibility – rms can change its design to suit a new production line.

6) diagnosability – rms has the ability to detect the defects and errors in the system.

4. IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN FMS

There are two major categories in Manufacturing. First is Continuous manufacturing and second is Discrete manufacturing. Now we will focus on a mathematical model of discrete manufacturing. It consists of three stages including part design, process design, process execution.



Part Design - The first stage is a conceptual and contains many constraints. The product planning function gives the request for particular set of functions like product performance level and its selling price in the marketplace. Management function contains design and development.

Process Design- this stage is similar to part design, except that it focuses more on designing process. It also contains many important constraints like the production facilities and the inventory of tools, parts and materials.

Process Execution- As our product is designed completely, next we have to execute the process. In the first step of process execution, all the raw materials and tools and parts are brought together with CNC machines. The second step in Process Execution includes assembly of products with the help of sensor-based robots. After this our product goes for finishing, inspecting, testing and finally gets stored in the storage system.

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