Role of Computer Integrated Manufacturing in Recent Trends in Manufacturing Technology

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***Abstract*-If we review the manufacturing scenario we will find that the manufacturing is characterized by a few islands of automation. In the case of design, the task is well automated. In the case of manufacture, CNC machines, DNC systems, FMC, FMS etc provide tightly controlled automation systems. Similarly computer control has been implemented in several areas like manufacturing resource planning, accounting, sales, marketing and purchase. Yet the full potential of computerization could not be obtained unless all the segments of manufacturing are integrated, permitting the transfer of data across various functional modules. This realization led to the concept of computer integrated manufacturing. Thus the implementation of CIM required the development of whole lot of computer technologies related to hardware and software.**

Keywords Automation, Computer Control, Advanced manufacturing technology

I. INTRODUCTION

Computer Integrated Manufacturing (CIM) encompasses the entire range of product development and manufacturing activities with all the functions being carried out with the help of dedicated software packages. The data required for various functions are passed from one application software to another in a seamless manner. For example, the product data is created during design. This data has to be transferred from the modeling software to manufacturing software without any loss of data. CIM uses a common database wherever feasible and communication technologies to integrate design, manufacturing and associated business functions that combine the automated segments of a factory or a manufacturing facility.

Manufacturing engineers are required to achieve the following objectives to be competitive in a global context.

- Reduction in inventory
- Lower the cost of the product
- Reduce waste
- Improve quality
- Increase flexibility in manufacturing
- Product changes
- Production changes
- Process change
- Equipment change
- Change of personnel

CIM technology is an enabling technology to meet the above challenges to the manufacturing environment.

A. DEFINITION OF CIM

CIM is defined differently by different users, and can be implemented in varying an increasing degree of complexity. For many companies, improving shop floor communications is the primary goal. Others extend the degree of integration to encompass communication between engineering and manufacturing functions. The ultimate benefit of CIM is the improvement of communication and control of information flow to all aspects of an enterprise.

The computer and automated systems association of the society of Manufacturing Engineers (CASA/SEM) defines CIM is the integration of total manufacturing enterprise by using integrated systems and data communication coupled with new managerial philosophies that improve organizational and personnel efficiency. CIM is recognized as Islands of Automation. They are

- CAD/CAM/CAE/GT
- Manufacturing Planning and Control.
- Factory Automation

II. CIM HARDWARE AND CIM SOFTWARE CIM Hardware

comprises the following:

1. Manufacturing equipment such as CNC machines or computerized work centers, robotic work cells, DNC/FMS systems, work handling and tool handling devices, storage devices, sensors, shop floor data collection devices, inspection machines etc.

2. Computers, controllers, CAD/CAM systems, workstations / terminals, data entry terminals, bar code readers, printers, plotters and other peripheral devices, modems, cables, connectors etc., CIM software c0omprises computer programs to carry out the following functions:

- Management Information
- System Inventory Control
- Shop Floor Data Collection
- Order Entry
- Database Management
- Work Flow Automation
- Materials Handling
- Analysis
- Process Planning Simulation
- Manufacturing Facilities Planning
- Modeling and Design

III. THE ELEMENTS OF CIM SYSTEM Nine major

elements of a CIM system are as follows:

- Marketing
- Product Design
- Planning
- Purchase
- Manufacturing Engineering
- Factory Automation Hardware
- Warehousing
- Finance
- Information Management

i. Marketing: The need for a product is identified by the marketing division. The specifications of the product, the projection of manufacturing quantities and the strategy for marketing the product are also decided by the marketing department. Marketing also works out the manufacturing costs to assess the economic viability of the product.

ii. Product Design: The design department of the company establishes the initial database for production of a proposed product. In a CIM system this is accomplished through activities such as geometric modeling and computer aided design while considering the product requirements and concepts generated by the creativity of the design engineer. Configuration management is an important activity in many designs. Complex designs are usually carried out by several teams working simultaneously, located often in different parts of the world. The design process is constrained by the costs that will be incurred in actual production and by the capabilities of the available production equipment and processes. The design process creates the database required to manufacture the part.

iii. Planning: The planning department takes the database established by the design department and enriches it with production data and information to produce a plan for the production of the product. Planning involves several subsystems dealing with materials, facility, process, tools, manpower, capacity, scheduling, outsourcing, assembly, inspection, logistics etc. In a CIM system, this planning process should be constrained by the production costs and by the production equipment and process capability, in order to generate an optimized plan.

iv. Purchase: The purchase departments is responsible for placing the purchase orders and follow up, ensure quality in the production process of the vendor, receive the items, arrange for inspection and supply the items to the stores or arrange timely delivery depending on the production schedule for eventual supply to manufacture and assembly.

v. Manufacturing Engineering: Manufacturing Engineering is the activity of carrying out the production of the product, involving further enrichment of the database with performance data and information about the production equipment and processes. In CIM, this requires activities like CNC programming, simulation and computer aided scheduling of the production activity. This should include online dynamic scheduling and control based on the real time performance of the equipment and processes to assure continuous production activity. Often, the need to meet fluctuating market demand requires the manufacturing system flexible and agile.

vi. Factory Automation Hardware: Factory automation equipment further enriches the database with equipment and process data, resident either in the operator or the equipment to carry out the production process.

In CIM system this consists of computer controlled process machinery such as CNC machine tools, flexible manufacturing systems (FMS), Computer controlled robots, material handling systems, computer controlled assembly systems, flexibly automated inspection systems and so on.

vii. Warehousing: Warehousing is the function involving storage and retrieval of raw materials, components, finished goods as well as shipment of items.

viii. Finance: Finance deals with the resources pertaining to money. Planning of investment, working capital, and cash flow control, realization of receipts, accounting and allocation of funds are the major tasks of the finance departments.

ix. Information Management: Information Management is perhaps one of the crucial tasks in CIM. This involves master production scheduling, database management, communication, manufacturing systems integration and management information systems.

IV. APPLICATIONS OF CIM

A. Automated Guided Vehicle Systems

An automated or automatic guided vehicle system (AGVS) is a materials handling system that uses independently operated, self-propelled vehicles that are guided along defined pathways in the floor. The vehicles are powered by means of on-board batteries that allow operation for several hours (8 to 16 hours is typical) between recharging. The definition of the pathways is generally accomplished using wires embedded in the floor or reflective paint on the floor surface. Guidance is achieved by sensors on the vehicles that can follow the guide wires or paint.

Automated guided vehicles (AGVs) increase efficiency and reduce costs by helping to automate a manufacturing facility or warehouse.

AGVS can carry loads or tow objects behind them in trailers to which they can autonomously attach. The trailers can be used to move raw materials or finished product. The AGV can also store objects on a bed. The objects can be placed on a set of motorized rollers (conveyor) and then pushed off by reversing them. Some AGVs use forklifts to lift objects for storage. AGVs are employed in nearly every industry, including, pulp, paper, metals, newspaper, and general manufacturing. Transporting materials such as food, linen or medicine in hospitals is also done.

B. Automated Assembly Systems

Assembly involves the joining together of two or more separate parts to form new entity which may be assembly or subassembly. Automated assembly refers to the use of mechanized and automated devices to perform the various functions in an assembly line or cell.

Automated assembly system performs a sequence of automated operations to combine multiple components in to a single entity which can be a final product or sub assembly.

Automated assembly technology should be considered when the following condition exists.

- High product demand
- Stable product design
- The product is designed for automated assembly.

V. CONCLUSION

CIM reduces the human component of manufacturing and thereby relieves the process of its slow, expensive and error-prone component.

CIM stands for a holistic and methodological approach to the activities of the manufacturing enterprise in order to achieve vast improvement in its performance.

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