

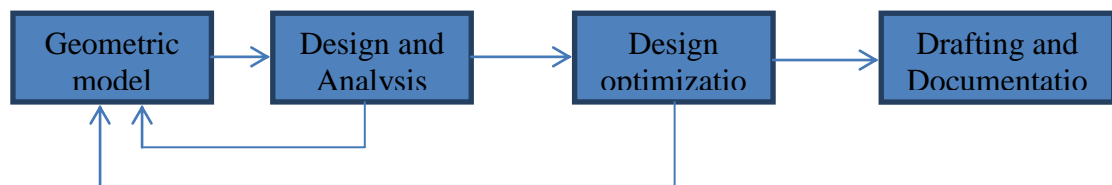
Chapter 8: Modern Trends in Manufacturing

Basic concepts of CAD

Computer Aided Design (CAD) involves the use of computer in

- Creating
- Analyzing
- Modifying
- Optimizing
- Drafting/ Documenting

A product data so as to achieve its design goal efficiently and effectively. The various phases of CAD section are presented in the following form:



As per the above figure, there are four phases of CAD process. A geometric model is generated first. It is analyzed for the desired design conditions and is optimized before finally getting documented and drafted.

CAD tool includes the following three elements.

(i) Computer modelling and computer graphics

Geometric modelling and computer graphics help to generate and visualize models on which the analysis is done subsequently. Modelling and designing are being used as synonyms now a day's. The kind of analysis which can be done on a model is controlled by the type of model used. Hence the computer aided model must be made only after confirming the kind of analysis which is to be performed on the model. Eg. Some model may not work for fluid dynamics and vibration analysis.

(ii) Analysis and optimization tools

These are the algorithms and programs for exclusive application which are applied on to the virtual product already modelled. This section can predict the behaviour of the model under the loading condition when all constraints are simulated using boundary conditions. The analysis process is iterated number of times with varying attributes to optimize the results. The results so obtained from the model can be anticipated from the behavior of actual model in real situation.

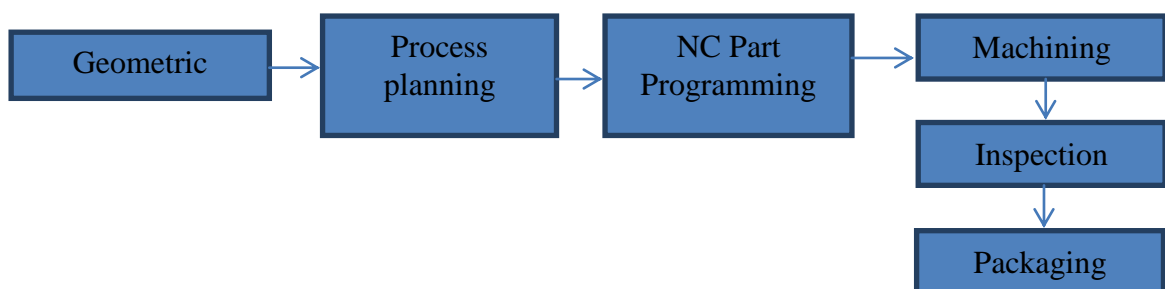
(iii) Drafting and documentation

The model already created, analysed and optimized guarantees a safe model under the real conditions. This safe model drawing is to be communicated to production floor with technical illustrations. The tool used for this application is called Computer Aided Drafting or called Computer Aided Design and Drafting (CADD). Computer Aided Modelling/Designing and Computer Aided Drafting represent two different concepts. Their differences are presented in the following:

Sl.No.	Computer Aided Modelling/Designing	Computer Aided Drafting
1.	This is done before analysis is performed on the geometric model.	This is done after analysis is performed on the geometric model.
2.	This provides dimension which may/maynot be safe.	The dimensions are safe since these are obtained after the analysis.
3.	This is 2D drawing/3D model	This is generally 2D drawing.
4.	This model is used for design analysis	These are made basically for conveying the production design.

Basic concepts of CAM (Computer Aided Manufacturing)

CAM is defined as a process of use of computers in planning, manufacturing, inspecting and controlling the manufacturing operation directly or indirectly. CAM includes those activities which manufacture the product with the product drawing and technical illustration as a input from the CAD and then make the product ready for shipment after inspection and packaging. The various phases of CAM section are shown below.



CAM Processes

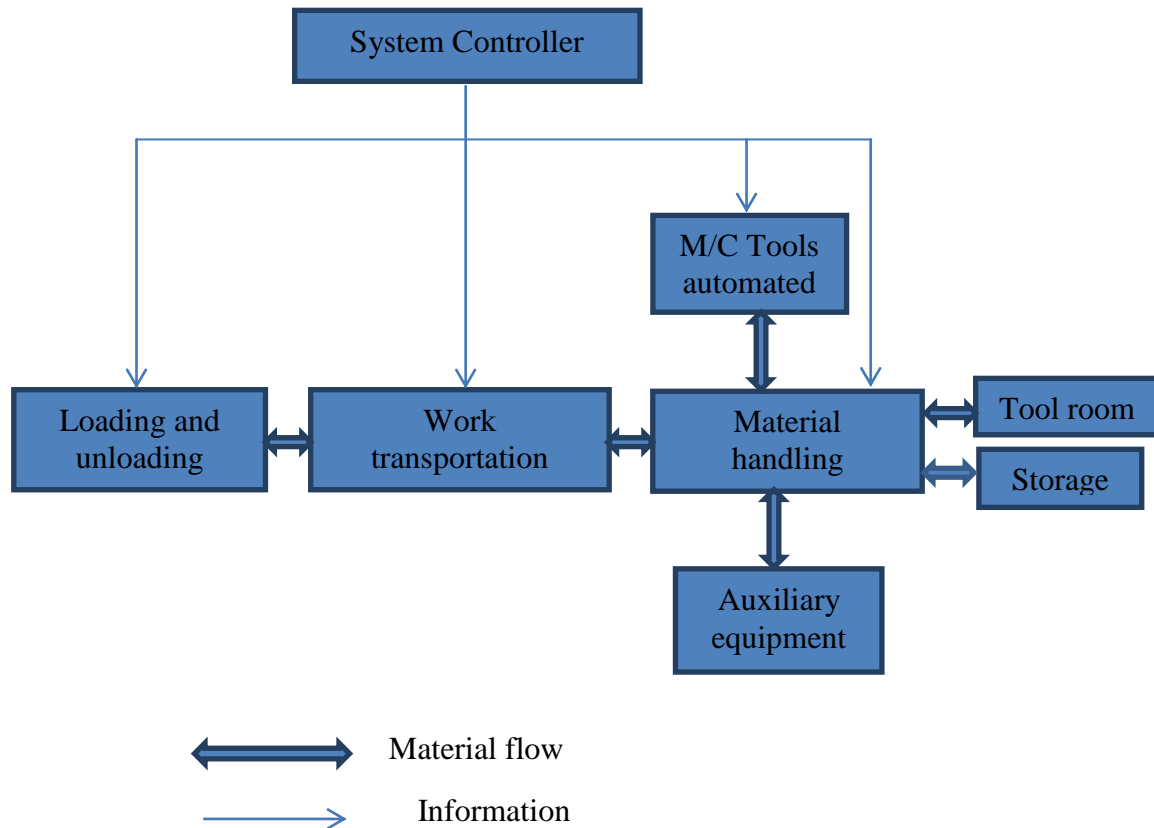
In CAM, the basic information required is actually geometrical information which is supplied to the CAM processes through the CAD model already generated and analyzed. Interface algorithm extract that necessary geometrical information from the CAD model and feed it for process planning, part programming, machining, inspection and packaging.

CAM tool includes the following three elements:

- (i) **CAD Tool:** The basic geometric information of the model is extracted from the geometric model created in the CAD phase of the product cycle. From the model necessary information regarding the shape, contour and sizes is extracted so as to implement in the manufacturing tool.
- (ii) **Manufacturing tool:** The fundamental of manufacturing process which are used defines the manufacturing tool. It describes the method in which the product can be manufactured. This includes generation of part programming and manufacturing and computer aided process planning (CAPP) and tool and cutter design, etc.
- (iii) **Networking tools:** The knowledge of networking and interfaces is required for communication capability between various machines and computers. e.g. transferring a part program from one computer to 04 different machines, controlling a robot from a computer etc. a communication or networking tool is a must for CAM to be operational effectively.

CAM employs computers for 02 basic purposes:

- (a) **Computer monitoring and control:** Where computers are used to control and monitor the applications. The major applications include in this category are: controlling machines and robots.
- (b) **Manufacturing support application:** It includes those applications which are not controlled directly by computer but are used to support the primary and direct operation. Such applications include numeric part programming, CAPP, generating computer aided schedules and all other kinds of planning.
- (c) **Flexible Manufacturing System (FMS):** A FMA integrates all major elements of manufacturing into a highly automated system. FMS has born in the latter half of 1960's as a means to improve productivity of small and medium volume production.



Structure of FMS

The major components are:

- Automated m/c tools:** In order to achieve the system flexibility, NC/Computer controlled general purpose m/c tools are normally used.
- Work transportation device:** These devices are used to carry parts between loading area and machining station. Individual conveyors are used for high degree of flexibility.
- Material handling device:** These devices transport work in process or tools to assigned positions.
- Loading and unloading station:** The raw materials and/or finished parts are loaded/unloaded in this area by robot.
- Tool room and storage:** All the tools used in this system are stored in the tool room and transported to machining centers when required.
- Auxiliary equipments:** Besides m/c tools, an FMS can also include cleaning online inspection, automated measurement and gauging equipments.
- System controller:** The system controller oversees the operation of entire FMS. It coordinates the operation of variety of equipments in the system.