Introduction to CAD/CAM

Throughout the history of our industrial society, many inventions have been patented and whole new technologies have evolved. Perhaps the single development that has impacted manufacturing more quickly and significantly than any previous technology is the digital computer. Computers are being used increasingly for both design and detailing of engineering components in the drawing office.

Computer-aided design (CAD) is defined as the application of computers and graphics software to aid or enhance the product design from conceptualization to documentation. CAD is most commonly associated with the use of an interactive computer graphics system, referred to as a CAD system. Computer-aided design systems are powerful tools and in the mechanical design and geometric modeling of products and components.

There are several good reasons for using a CAD system to support the engineering design function:

- To increase the productivity
- To improve the quality of the design
- To uniform design standards
- To create a manufacturing data base
- To eliminate inaccuracies caused by hand-copying of drawings and inconsistency between drawings

Computer-aided manufacturing (CAM) is defined as the effective use computer technology in manufacturing planning and control. CAM is most closely associated with functions in manufacturing engineering, such as process and production planning, machining, scheduling, management, quality control, and numerical control (NC) part programming. Computer-aided design and computer-aided manufacturing are often combined CAD/CAM systems.

This combination allows the transfer of information from the design into the stage of planning for the manufacturing of a product, without the need to reenter the data on part geometry manually. The database developed during CAD is stored; then it is processed further, by CAM, into the necessary data and instructions for operating and controlling production machinery, material-handling equipment, and automated testing and inspection for product quality.

Rationale for CAD/CAM

The rationale for CAD/CAM is similar to that used to justify any technology-based improvement in manufacturing. It grows out of a need to continually improve productivity, quality and competitiveness. There are also other reasons why a company might make a conversion from manual processes to CAD/CAM:

- Increased productivity
- Better quality
- Better communication
- Common database with manufacturing
- Reduced prototype construction casts
- Faster response to customers
CAD/CAM Hardware

The hardware part of a CAD/CAM system consists of the following components (1) one or more design workstations, (2) digital computer, (3) plotters and other output devices, and (4) storage devices. The relationship among the component is illustrated in Fig.10.1. In addition, the CAD/CAM system would have a communicatio interface to permit transmission of data to and from other computer systems, thus enabling some of the benefits of computer integration.

The workstation is the interface between computer and user in the CAD system. The design of the CAD workstation and its available features have an important influence on the convenience, productivity, and quality of the user’s output. The workstation must include a digital computer with a high-speed control processing unit (CPU). It contains require a and logic/arithmetic section for the system. The most widely used secondary storage medium in CAD/CAM is the hard disk, floppy diskette, or a combination of both.

The typical I/O devices used in a CAD system are shown in Fig.10.2. Input devices are generally used to transfer information from a human or storage medium to a computer where “CAD functions” are carried out. There are two basic approaches to input an existing drawing: model the object on a drawing or digitize the drawing. The standard output device for CAD/CAM is a CRT display. There are two major of CRT displays: random-scan-line-drawing displays and raster-scan displays. In addition to CRT, there are also plasma panel displays and liquid-crystal displays.

CAD/CAM Software

Software allows the human user to turn a hardware configuration into a powerful design and manufacturing system. CAD/CAM software falls into two broad categories, 2-D and 3-D, based on the number of dimensions are called 2-D representations of 3-D objects is inherently confusing. Equally problem has been the inability of manufacturing personnel to properly read and interpret complicated 2-D representations of objects. 3-D software permits the parts to be viewed with the 3-D planes-height, width, and depth-visible. The trend in CAD/CAM is toward 3-D representation of graphic images. Such representation approximate the actual shape and appearance of the object to be produced; therefore, they are easier to read and understand.

Applications of CAD/CAM

The emergence of CAD/CAM has had a major impact on manufacturing, by standardizing product development and by reducing design effort, tryout, and prototype work; it has made possible significantly reduced costs and improved productivity.

Some typical applications of CAN/CAM are as follows:
Programming for NC, CNC, and industrial robots;
Design of dies and molds for casting, in which, for example, shrinkage
allowances are preprogrammed;

- Design of tools and fixtures and EDM electrodes;
- Quality control and inspection—for instance, coordinate-measuring machines programmed on a CAD/CAM workstation;
- Process planning and scheduling.

AutoCAD is a computer-aided drafting and design system implemented on a personal computer. It supports a large number of devices. Device drivers come with the system and include most of the digitizers, printer/plotters, video display boards, and plotters available on the market.

AutoCAD supports 2-D drafting and 3-D wire-frame models. The system is designed as a single-user CAD package. The drawing elements are lines, polylines of any width, arcs, circles, faces, and solids. There are many ways to define a drawing element. For example, a circle can be defined by center and its radius, three points, and two end points of its diameter. The system always prompts the user for all options.

Of course, the prompt can be turned off by advanced users. Annotation and dimensioning are also supported. Text and dimension symbols can be placed on anywhere on the drawing, at any angle, and at any size. A variety of fonts and styles are also available.