Computer Aided Design (CAD)

Introduction to CAD

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What is CAD?

- Originally CAD includes any techniques that use computers in the design process including drafting, stress analysis and motion analysis.
- But over the last 35 years, CAD has come to refer more specifically to Computer Aided Design and Drafting.
- CAD program/software is an electronic tool that enables you to make quick and accurate drawings with the use of a computer.

What is CAD?

- Computer drawings are neat, clean, highly presentable, and can be modified easily.
- With CAD, parts or components can be modeled, visualized, revised, and improve on the computer screen before any engineering drawings have been created.

What is CAD?

- Parts that have been modeled can be assembled in the virtual environment of the computer. The relative motion of moving parts can be animated on the computer. The part can be analysed computationally and redesigned. The machine tool path or mold filling flow to fabricate the part can be modeled on the computer. The part model can be downloaded to a rapid prototyping system that can create a physical model of the part in a few hours with virtually no human intervention.

Capabilities of CAD

Some of the important capabilities of using CAD are;

1) Presentations
   - You can create fine drawings with presentation symbols and text styles.
   - You can use CAD program to make on screen presentations.

Capabilities of CAD

2) Flexibility in editing

- CAD provides the flexibility to make quick alterations to drawings
- Some of the editing capabilities are such as; move or copy drawing elements, enlarge or reduce size of a drawing, make multiple copies of a drawing, change units of measure and etc.

Capabilities of CAD

3) Units and accuracy level

- CAD program allows you to work with great accuracy. You can also work with different units of measure, such as architectural units, engineering units, scientific units and surveyor units.

4) Storage and access of drawings

- It is quick and convenient to organize CAD drawings. You can have thousands of drawings on a computer's hard disk and you can open any one of them within seconds.

Capabilities of CAD

5) Sharing CAD drawings

- The drawings can be shared by a number of users, allowing them to coordinate projects and work as a team. This is accomplished by connecting different computers via a network. You can also publish your drawings on the Internet and collaborate CAD projects using a web site.

Capabilities of CAD

6) Project reporting

   - The computer can be used to prepare project reports

7) Engineering analysis

   - There is a separate category of programs called CAE that can use CAD drawings for engineering analysis.

Capabilities of CAD

8) Computer aided manufacturing (CAM)
   - CAM is a common method of manufacturing used by large corporations.
   - These systems import CAD drawings into CAM programs to automate the manufacturing process.

CAD Models

- A CAD model is a computer representation of an object or part
- It contains all of the design information including geometry, dimensions, tolerances, materials and manufacturing information.
- CAD models replace the paper blueprints and engineering drawings
- The simplest model used in CAD is a 2D model. This model is essentially the computer graphics equivalent to an orthographic projection

CAD Models

- A 3D model is the most general model used in CAD software. This model is equivalent to an isometric view
- 2 basic types of 3D models are wire frame and surface models.
- In a 3D wire frame model, only edges of the object are represented.
- A 3D surface model defines the object in terms of surfaces such as plates (flat) and shells (curved) in addition to edges.

Solid Modeling

- The current state of the art in CAD, is the most sophisticated method of representing an object. Unlike wire frame or surface models, a solids model represents an object in the virtual environment just as it exists in reality, having volume as well as surfaces and edges. In this way, the interior of the object is represented in the model as well as the outer surfaces.

Use of solid models

- Can be used for stress analysis, heat transfer analysis, fluid flow analysis, and computer aided manufacturing.
- In the manufacturing process to automatically generate machine tool paths to machine an object.
- To simulate the removal of material from an initial block of material on the computer
- Can be linked to Computer Numerical Control CNC) machine to carry out the removal of material automatically allowing many identical parts to be machined based directly on the solid models.