

LECTURE ONE

CHAPTER - 1

Introduction to CAD

Outlines

- ✓ *What is design?*
- ✓ *What is computer –Aided design(CAD)?*
- ✓ *Application of CAD in mechanical engineering*
- ✓ *Advantages of CAD over manual Drafting.*
- ✓ *How a CAD system is used in product design.*
- ✓ *CAD system hardware and software.*

1. What is Design?

- Design is the human power to imagine , plan, and realize products that serve human beings.
- Design is a complete prototype with analysis and manufacturing.

□ The design process

- Steps of the Conventional Design Process:

1. Recognition of need

- Someone recognizes the need that can be satisfied by a new design.

2. Problem definition

- Specification of the item.

Cont..

3. Synthesis

- creation and conceptualization

4. Analysis and optimization

- the concept is analyzed and redesigned

5. Evaluation

- compare design against original specification.

6. Presentation

- documenting the design (e.g. drawing)

Cont..

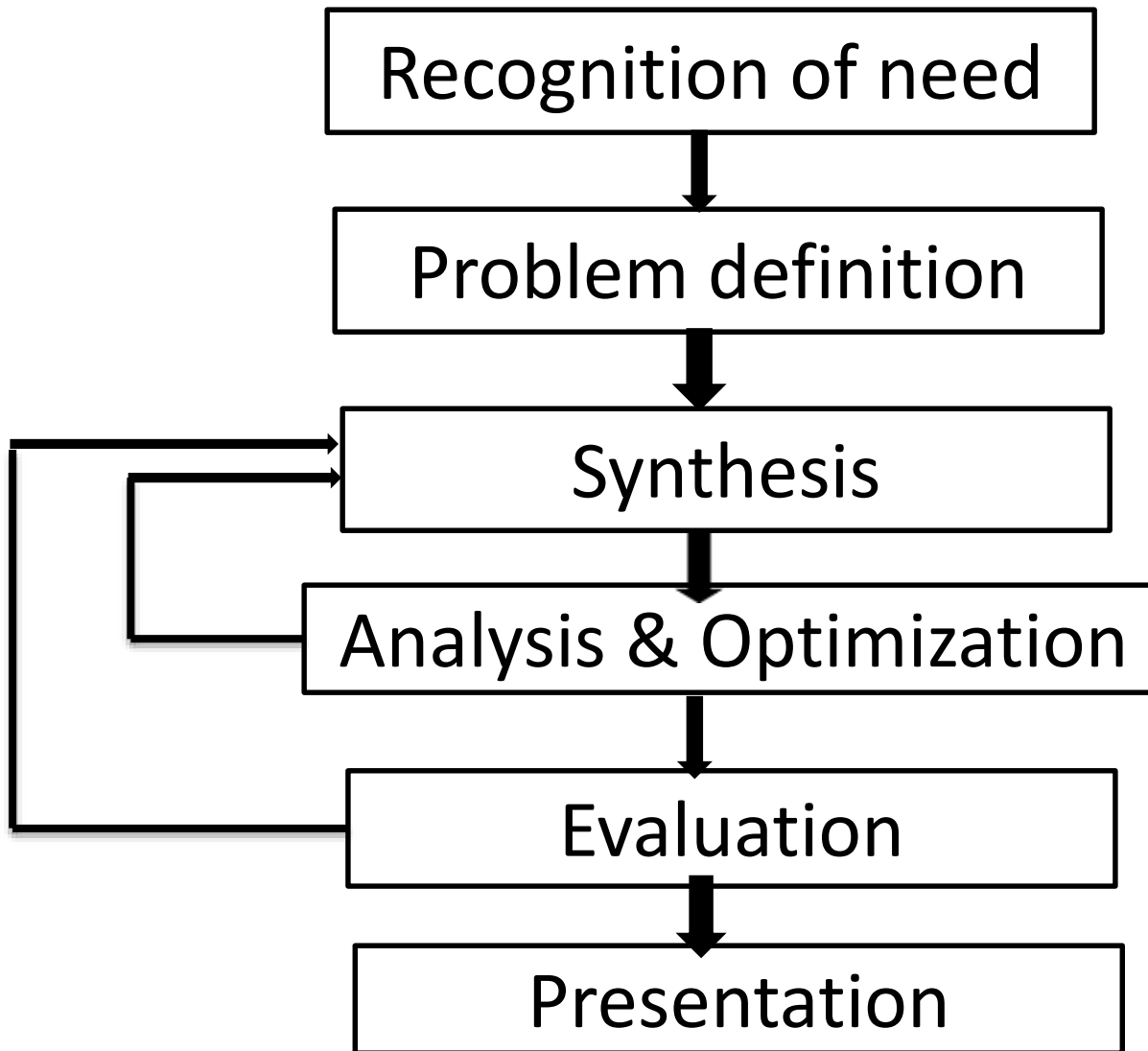


Figure: Stage in design process

Cont..

❑ What is Drawings?

- Drawing is rough sketch which give some message or information about production.(like shape of product)

❑ What is Drafting ?

- Drafting is a language of engineers with exact scaling, dimension, measurements, accuracy and with standard like ISO, ASEE...etc.

1.2 Computer – Aided Design (CAD)

- One of the main applications of computer technology is computer Aided design (CAD), side by side with the computer aided manufacturing (CAM).
- **CAD** stands for Computer Aided Design and Computer Aided Drafting.
- It's an integration of computer science techniques for engineering design.
- The term **computer aided design** characterizes any design activity which incorporates an electronic computing machine in the process of development , analysis or modification and optimization of design.

Cont..

❑ **What does mechanical engineers do in CAD?**

- Mechanical engineers do drafting and design and prototype testing (analysis) operation in CAD.
- Use to creates graphic representation of physical object.

❖ **Generally the main function of CAD is used to**

- Create graphic representation (create 2D/3D drafting)
- 3D modeling(individual component modeling and Assembly modeling)
- Used for analysis (stress analysis, kinematic analysis,..etc.)
- Used for simulation the system(collusion simulation, robotic simulation.. etc.)

1.3 Application of CAD in mechanical engineering

- Automotive industry
- Aerospace and air craft industry
- Textile industry
- Tool and die making industry
- Die manufacturing industry
- Welding and cutting industry
- Automobile industry
- Jigs and fixture manufacturing.. ect.

1.4 Advantage of CAD over manual Drafting

- Easy to draw
- Less time consumption
- More accuracy and precision
- Quick access
- Easier modification
- Good appearance in output
- Storage facility
- Less prone error
- Easy to share accurate information
- Better communication between users.
- Higher performance
- Increase efficiency of designers work.

Traditional

Design-Manufacturing Process
Old (before computer era)



Sketch with pencils

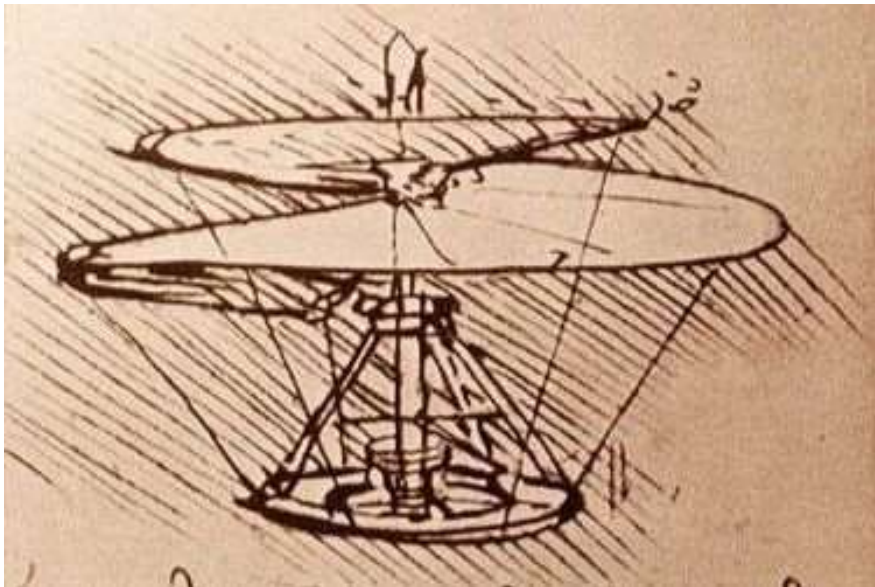


Engineering Drawing with pencils



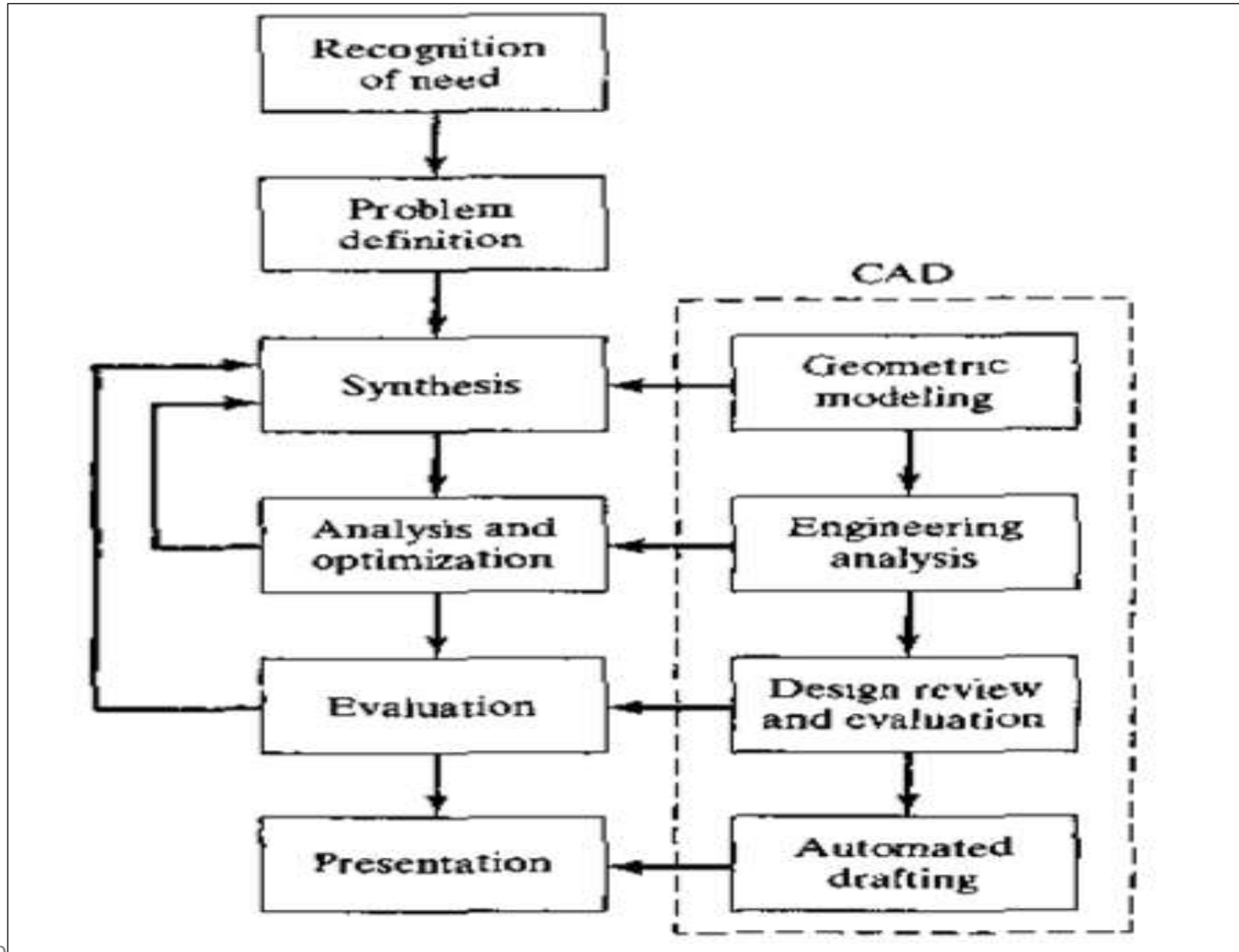
Manufacturing

Traditional vs Modern



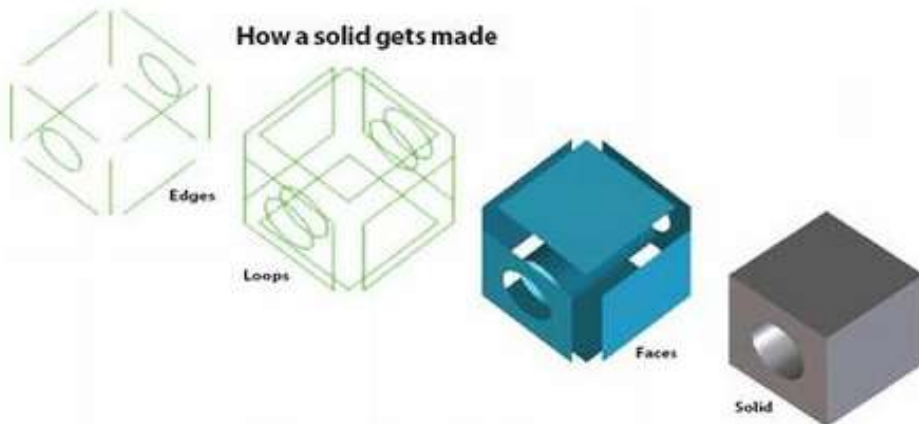
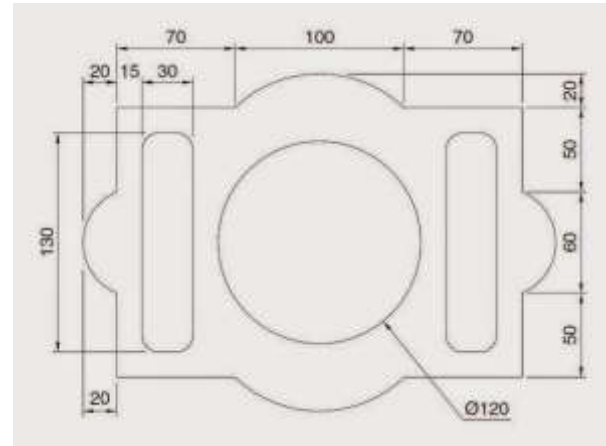
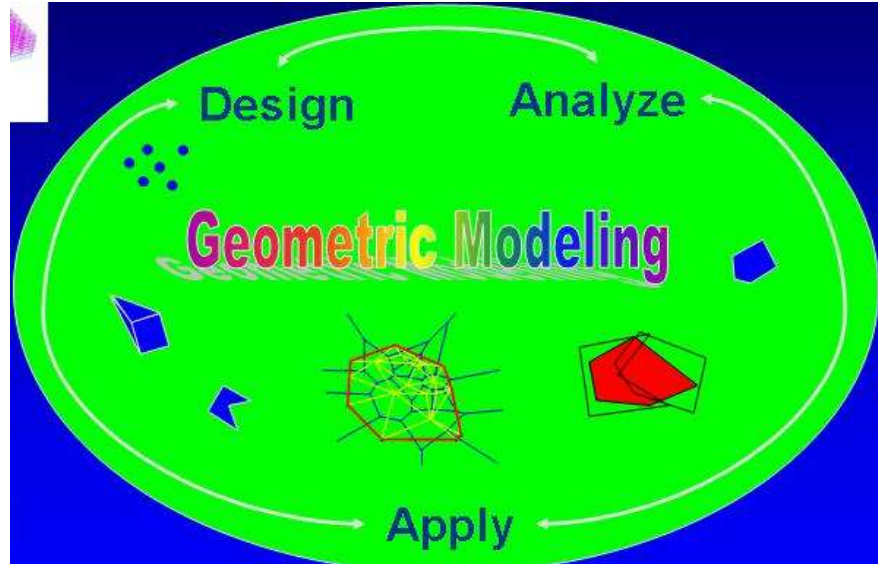
❖ HOW a CAD system is used in product design.

- There are 4 steps to design a product in CAD system



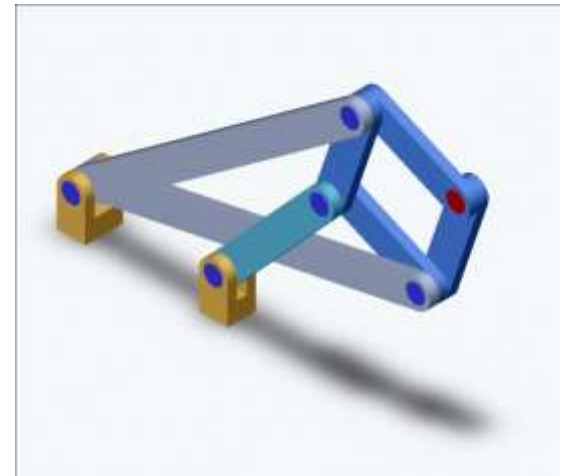
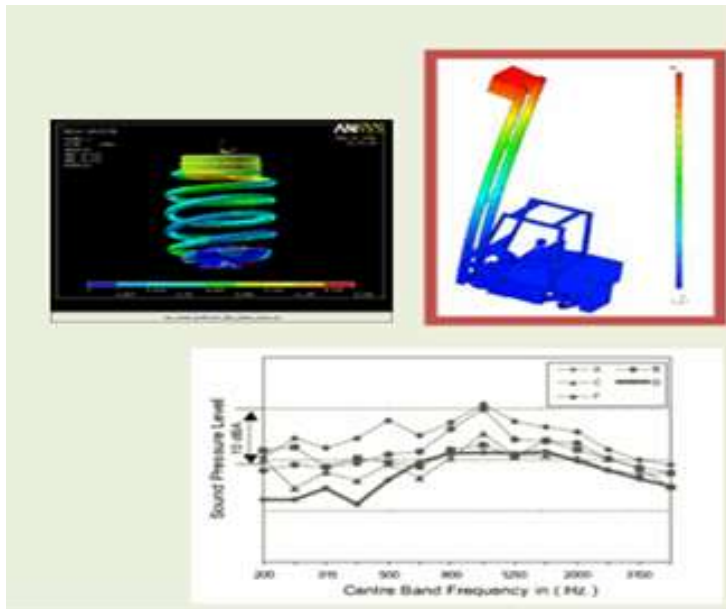
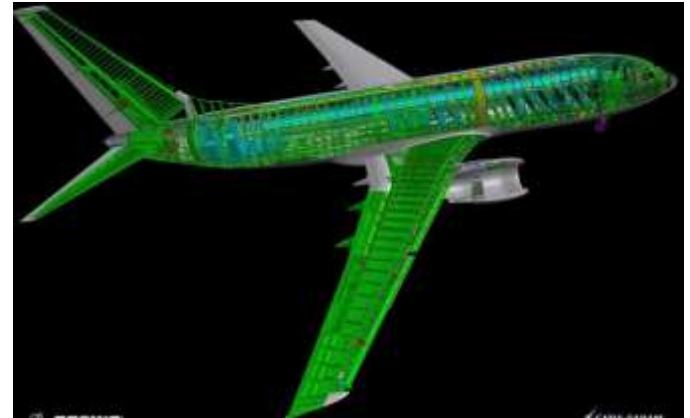
1. Geometric Modeling

- CAD system develops a mathematical description of the geometry of an object called a Geometric model.



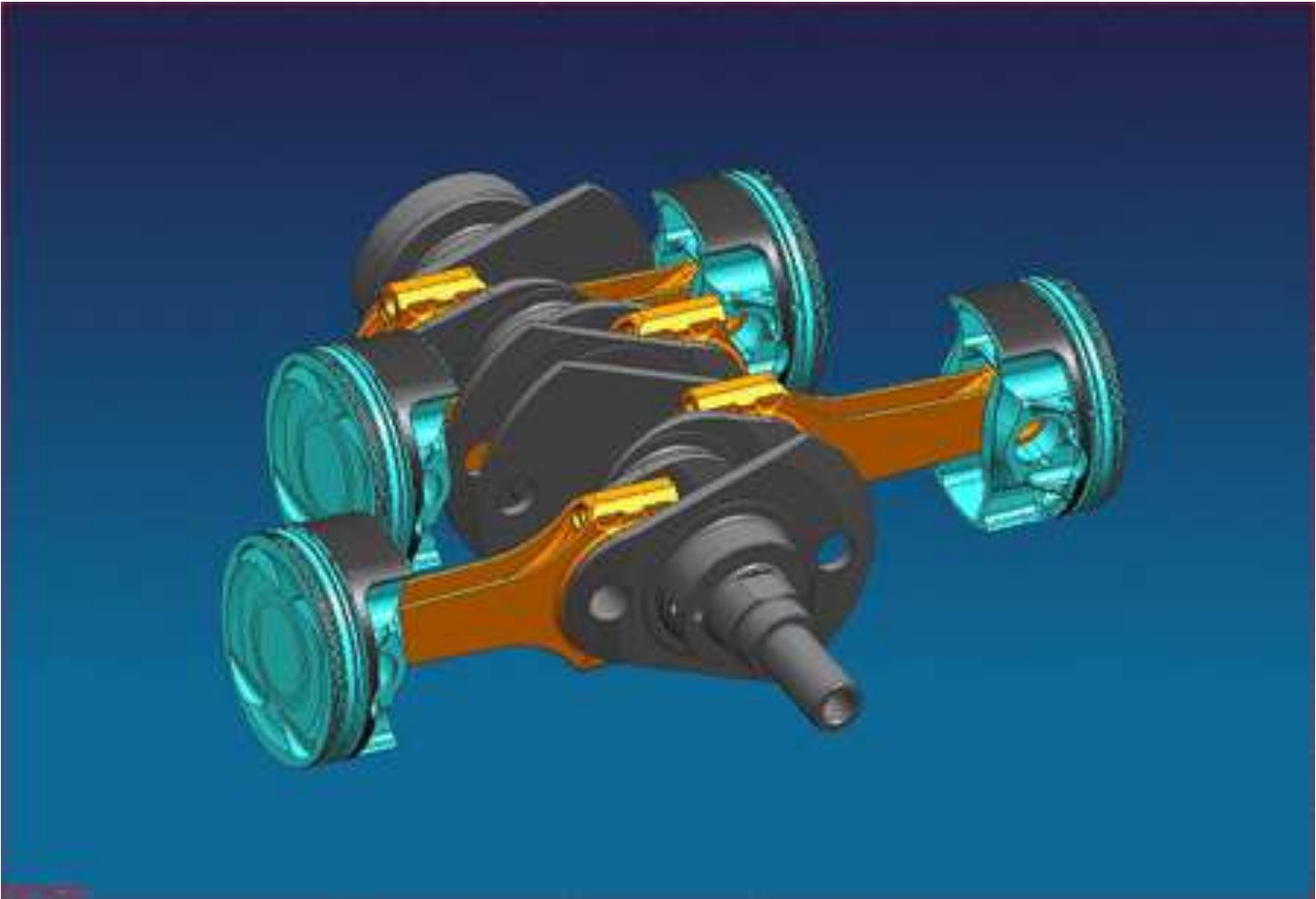
2. Engineering design and Analysis

- Mass properties,
- Interference checking assembly
- Finite element modeling
- Structural analysis
- Noise and vibration analysis
- Kinematic analysis for mechanisms.



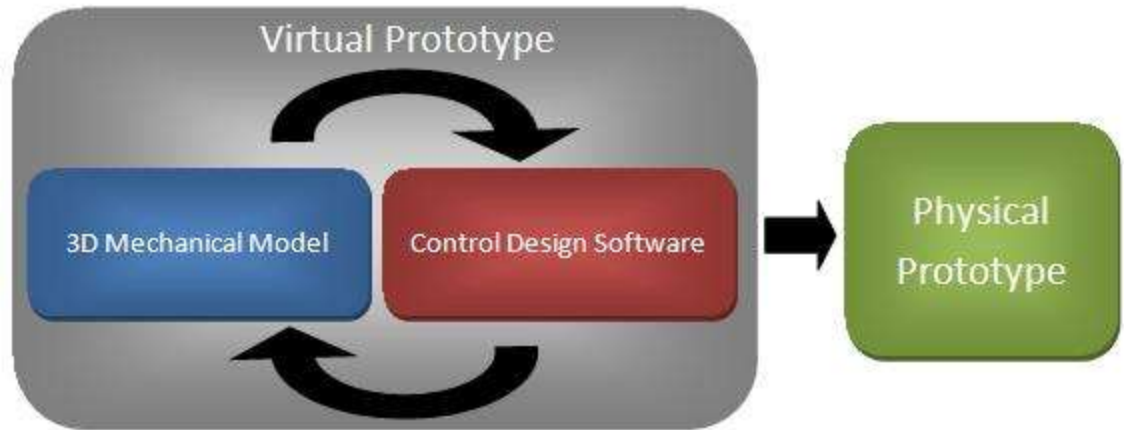
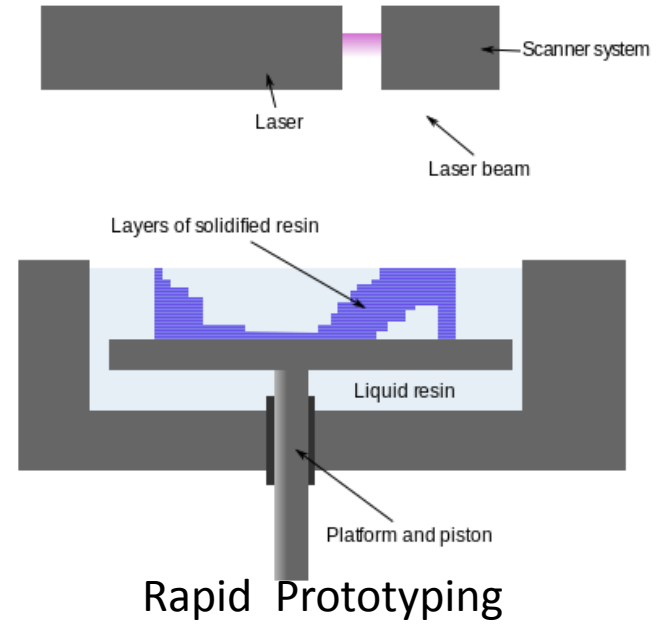
Engineering analysis cont....

Discrete event Simulation



3. Design review and Evaluation

- automatic dimensioning,
- prototyping
- error checking,
- Animation, etc.



Virtual Prototyping

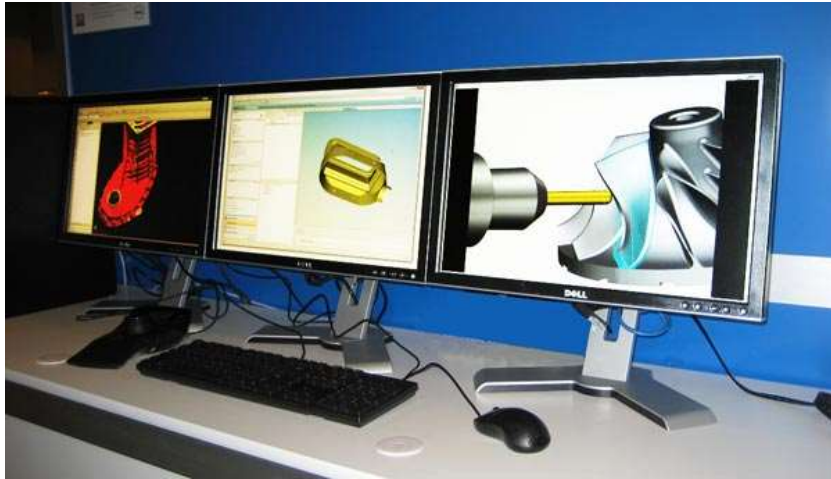
4. Automated drafting



❖ CAD systems Hard ware

- The hard ware for a typical CAD system consists of the following components:
 - 1. One or more design work station(graphics terminal and input device)**
 - Like keyboard, mouse, light pen, Scanner, jaystick
 - 2. Digital computer**
 - CPU
 - 3. Output devices**
 - Like display device(screen) , Hard copy device(Graphic printers, plotter, photographic device, Scanner)
 - 4. Storage device**
 - like Floppy disk, Magnetic disk(CD, DVD) , Magnetic tapes.

CAD HARDWARE



Some pointing devices are :

- *Trackball*
- *Pointing Stick*
- *Joystick*
- *Touch Pad*
- *Touch Screen*
- *Light Pen*



❖ CAD systems Graphics software

- The graphics software is the collection of programs written to make it convenient for a user to operate the Computer system.
- It's a collection of software used for modeling, Drafting, Analysis and optimization.

EXAMPLE:

- 1. For 2D Sketching(Drafting)** – AutoCAD, Autodesk ..
- 2. For 3D Modeling(Design)** – CATIA, Solid Work, Autodesk, Inventor,..
- 3. For Analysis and optimization(Simulation)** – ANSYS, Hyper works, ...