



CAD & CAM

MD inzamam ul islam
workshopsuper (Mechanical)
Mymensingh Polytechnic Institute

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Chapter-01

Understand basic concept of CAD & CAM

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INTRODUCTION

- ▣ In this CIM technology CAD/CAM play an effective role.
- ▣ CAD/CAM system is ideally suited for designing and manufacturing mechanical components of free from complex 2-dimensional and 3-dimensional shapes.
- ▣ CAD/CAM technology plays an important role in functioning of robots. In CAD/CAM system the robot work data is prepared from CAD data from the first designing process.

WHAT IS CAD/CAM?

- ▣ Computer-aided design (CAD), Computer aided manufacturing (CAM) can be defined as the use of digital computer to assist the designer in the:
 - ▣ Creation
 - ▣ Development
 - ▣ Modification
 - ▣ Analysis
 - ▣ Optimization of a design and manufacturing activity.

Why CAD/CAM?

- ▣ Computer Aided Design and Computer Aided Manufacture is the way things are made these days.
- ▣ Without this technology we wouldn't have the range and quality of products available or, at least, they wouldn't be available at a price most of us can afford.
- ▣ Hand-building and manual techniques still very much have their place and Design Education needs to treasure and foster these skills so that future generations will have the 'hands-on' skills to understand the man-made world and provide the next generation of engineers, designers and technicians.

Uses

- ▣ Computer-aided engineering (CAE) and Finite element analysis (FEA)
- ▣ Computer-aided manufacturing (CAM) including instructions to Computer Numerical Control (CNC) machines
- ▣ Photo realistic rendering
- ▣ Document management and revision control using Product Data Management (PDM).

Types

- ▣ 3D wireframe is basically an extension of 2D drafting (not often used today). Each line has to be manually inserted into the drawing.
- ▣ 3D "*dumb*" solids are created in a way analogous to manipulations of real world objects (not often used today).

Types

- ▣ *3D parametric solid* modeling allows the operator to use what is referred to as "design intent". The objects and features created are modifiable.
- ▣ *Explicit Modelers or Direct 3D CAD Modelers* provide the ability to edit geometry without a history tree.

INTERACTIVE COMPUTER GRAPHICS (ICG)

- ▣ ICG is an important part of CAD system. It is a user oriented system using computer to create, transform and display data in the form of pictures or symbols.

POTENTIAL APPLICATION AREAS OF CAD/CAM

- ▣ **Design and Design Analysis:** CAD system would be best suited for drawing offices where frequent modification are required on drawing and several parts repeat.
- ▣ It must be remembered that it very easy with computer to make modifications and very fast to draw part profile once it details are feed in computer.

THESE ARE FEW DESIGN MODEL OF CAD/CAM

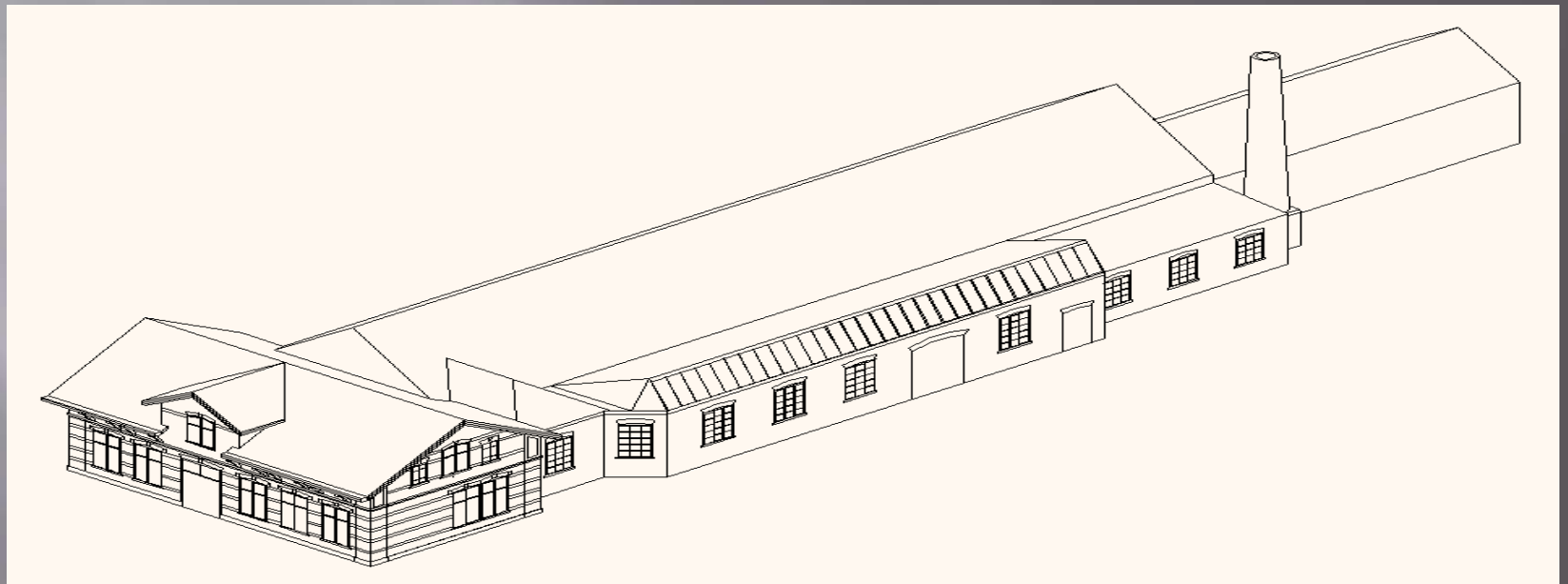
▣ VIEW OF ENGINE



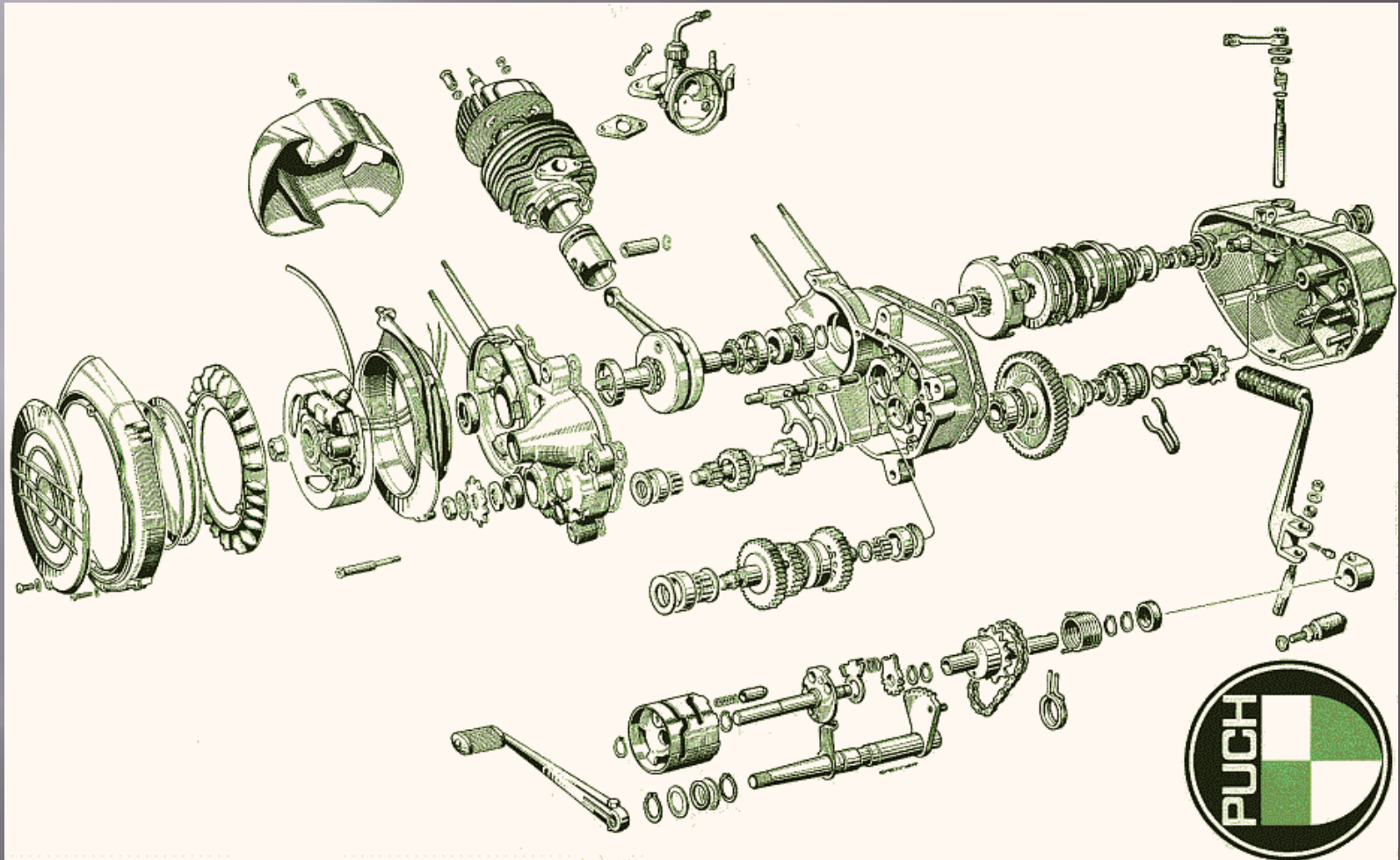
VIEW OF BRACKET



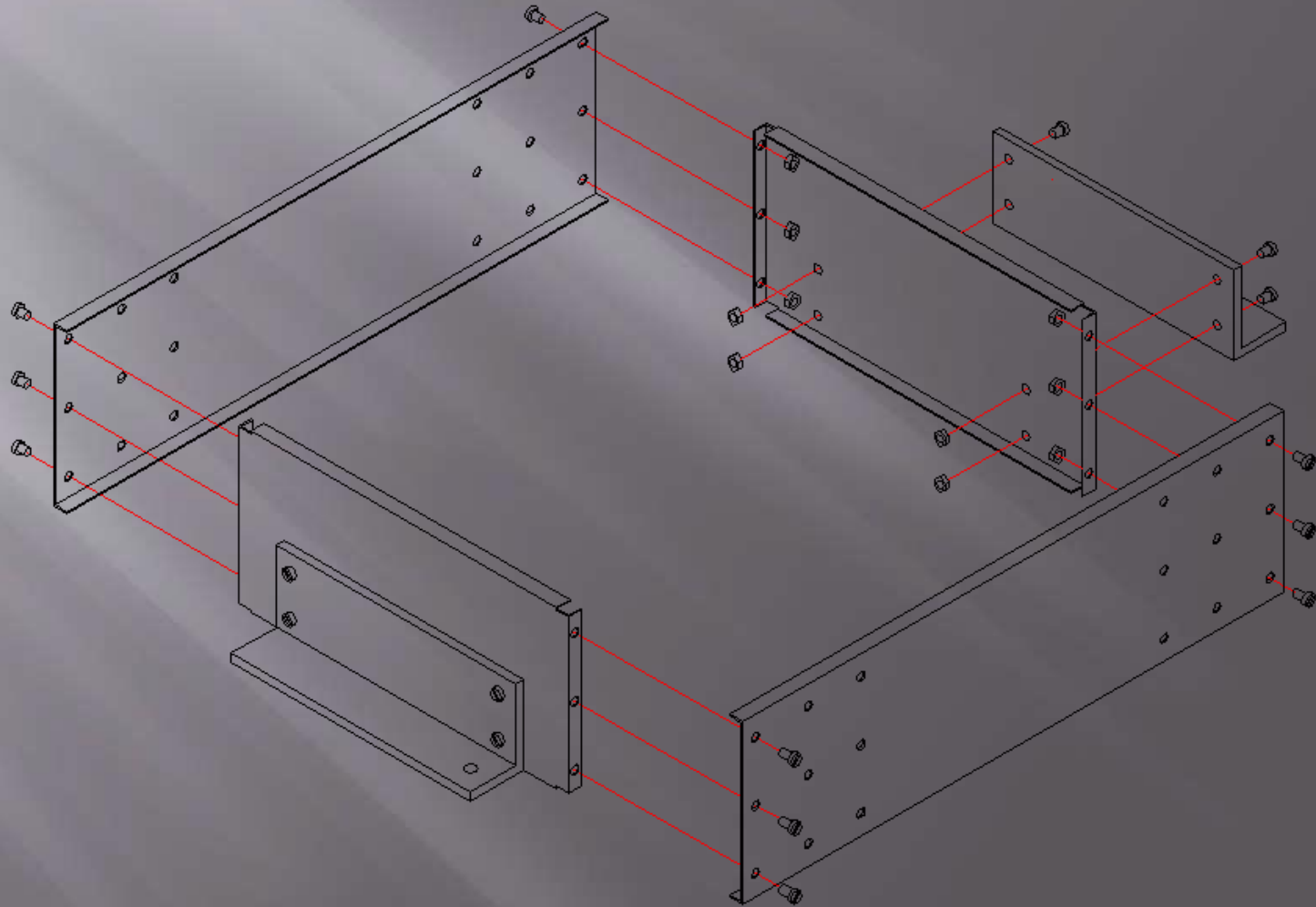
ISOMETRIC VIEW OF HOUSE



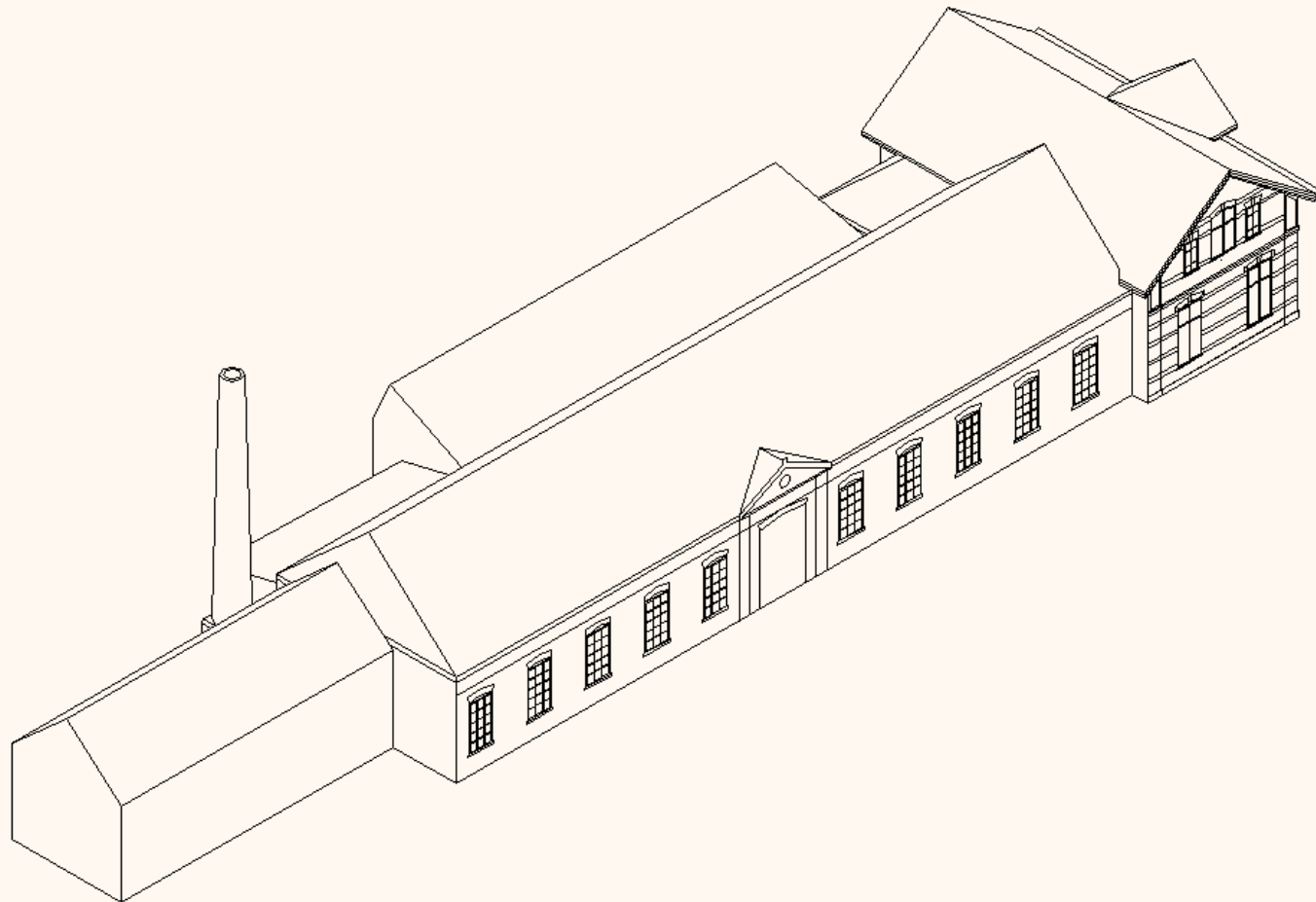
EXPLODED VIEW OF ENGINE



EXPLODED VIEW OF MOULD BOX



ISOMETRIC VIEW OF HOUSE



BENEFITS OF CAD/CAM

- ▣ Introduction of computer has resulted in a better and consistent quality product at reduced costs .
- ▣ CAD has enable creation of assemblies and parts in the computer, there analysis, optimization, stimulating the functionality, aesthetic requirements etc.
- ▣ It has resulted lead time in the design office.
- ▣ Easy referencing and material of earlier design, data and information.
- ▣ Dependence on design subcontractors is reduced.

Limitations of CAD- CAM

- ▣ There are two primary limitations to CAD CAM restorations. (Like Cerec and E4D) It is not yet possible to do multiple unit bridges and the esthetics is limited.
- ▣ The esthetics has improved dramatically from the early days as the quality of materials has improved. Multi shade material blocks can duplicate dentin and enamel shades.
- ▣ Never the less, CAD CAM is not suited for highly esthetic situations.

Conclusions

- ▣ Although the last seven years nothing revolutionary happened in the CAD tools ,the software's vendors support that in the short run many things will change the way of the mechanical design.
- ▣ The CAD in the future will be more easy to use and learn, and geared to enhance concept design and construction planning, will be functional and powerful enough to satisfy the needs of engineering design and integration of all disciplines, and corporate functions, sectors and levels.

References

- ▣ www.oeclib.in
- ▣ www.google.com
- ▣ www.wikipedia.com

THANKS

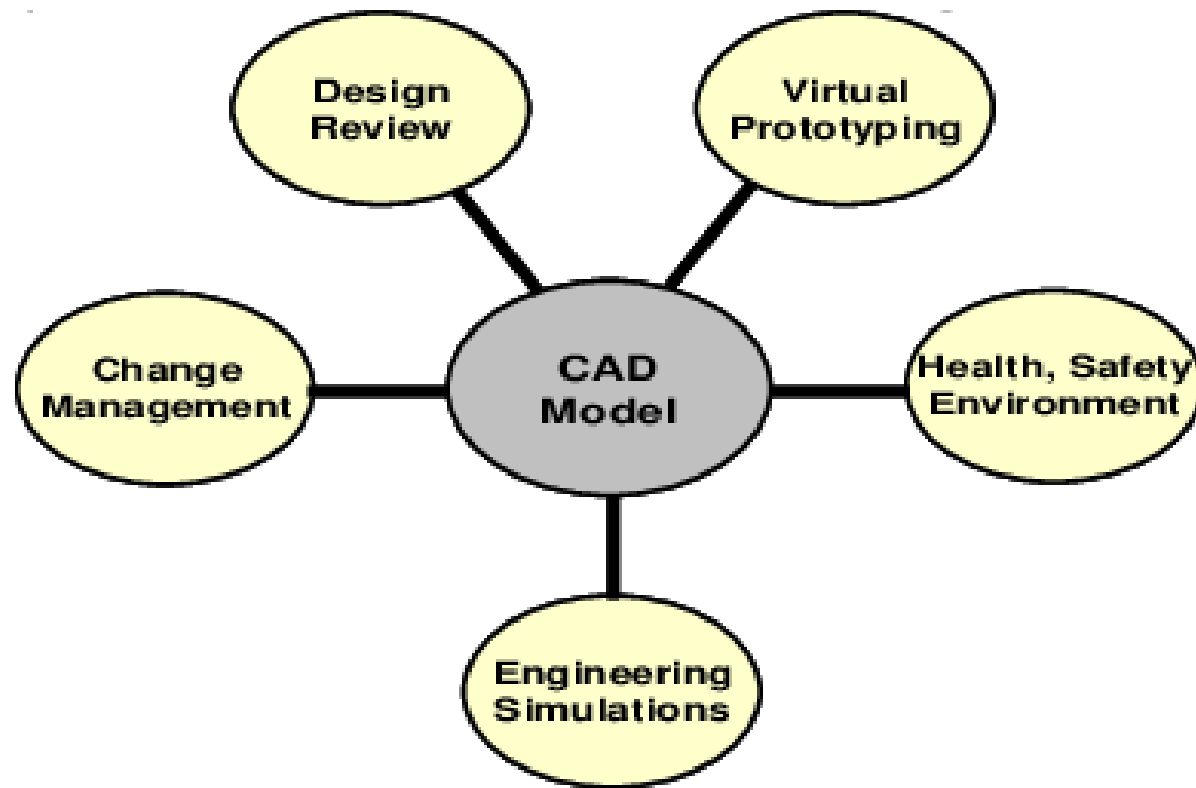
Chapter-2

Understand the Computer aided
drafting

Applications of cad models

- **Solid Modelling** This process is used to create solid components of desired shape by joining and cutting different solid volumes. The final solid model is a virtual replica of an actual product but it can be seen and rotated like a real product. There are two main types: · direct where the model can be edited by undoing or modifying the model directly on the 3D; · parametric where the model is constructed using parameters (variable quantities such as measurements) and the model can be edited at any point in its history.
- **Surface Modelling** This process is used to create surfaces of desired shape by trimming, stitching and joining different surfaces to create a final shape model

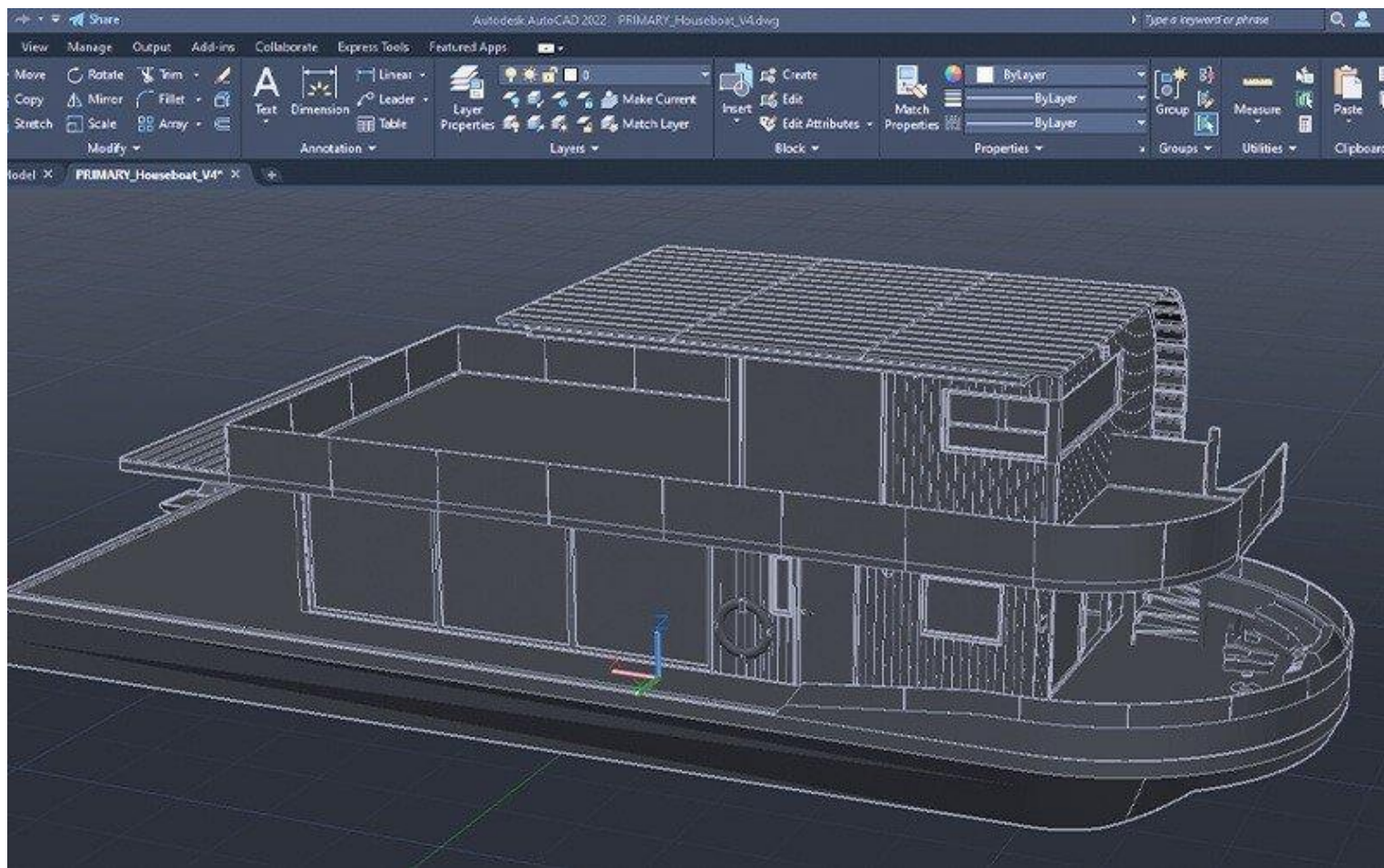
- **Assembly** This process is used to assemble the models created in solid or surface modelling to create a final assembly. This is used to see the actual fitment of all models and see the actual working of assembly.
- **Drafting Detailing** This process is used to create the 2D drawings of components or assemblies; usually directly from a 3D model, although 2D CAD can create 2D drawings directly.



Cad softwares

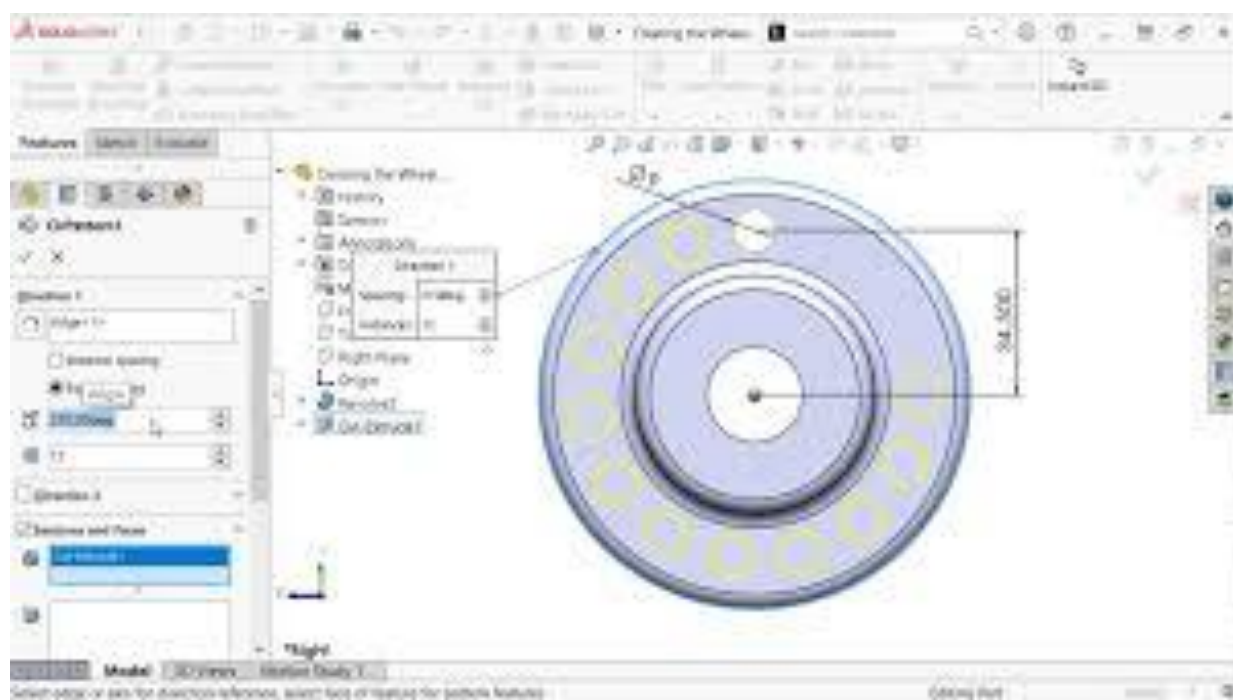
- **AutoCAD**

CAD (Computer Aided Design) is a tool that can be used for design and drafting activities. Since it uses the computing power of a processor, CAD drawings are faster, better and more accurate than their manually drafted counterparts. AutoCAD is sophisticated CAD software that is synonymous with engineering drafting.



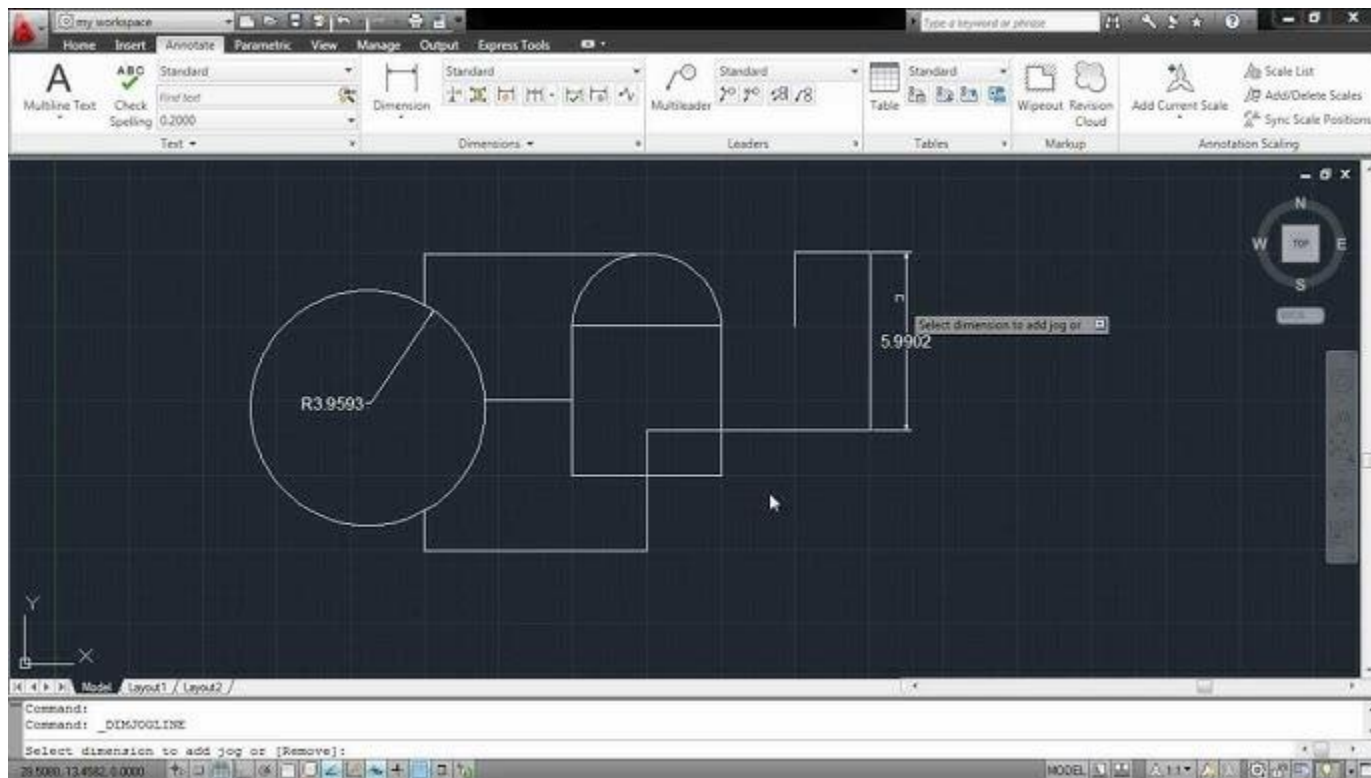
SOLIDWORKS

- The **SOLIDWORKS** Software The SOLIDWORKS® CAD software is a mechanical design automation application that lets designers quickly sketch out ideas, experiment with features and dimensions, and produce models and detailed drawings. This document discusses concepts and terminology used throughout the SOLIDWORKS application. It familiarizes you with the commonly used functions of SOLIDWORKS.

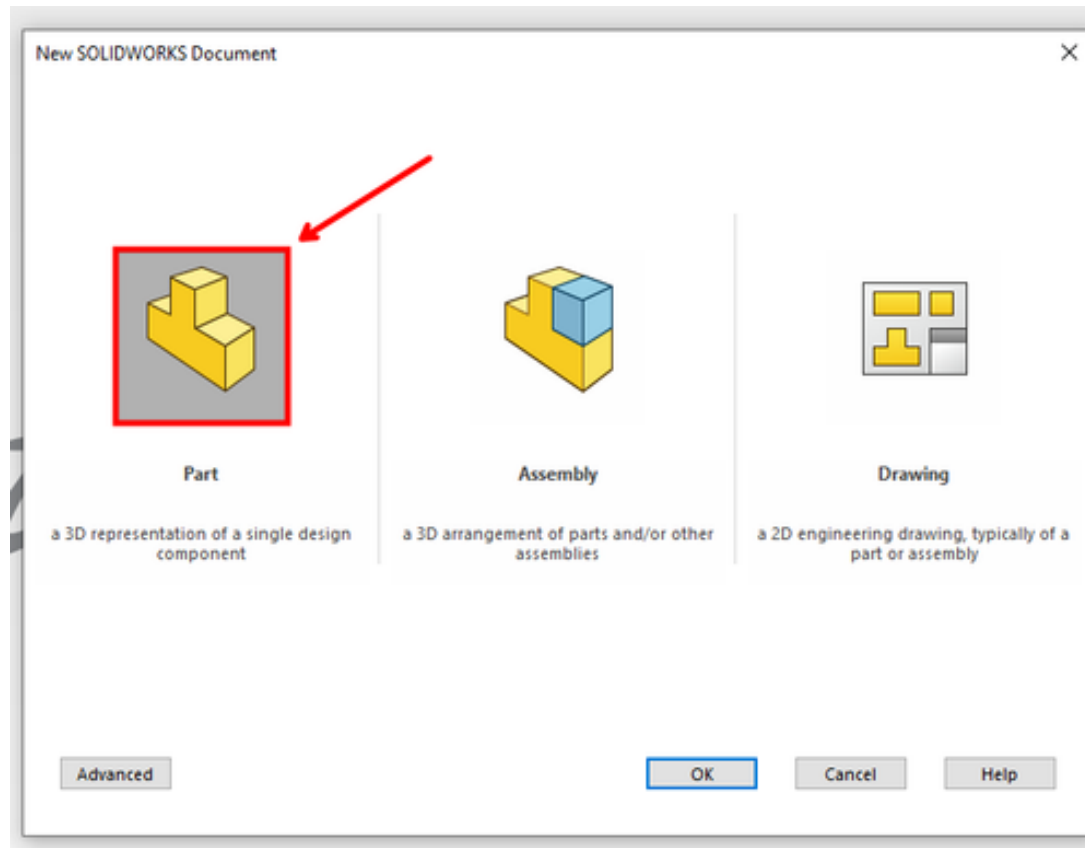


The DIMENSION command

- The DIMENSION command adds dimensions to your drawing. To use this command, type “DIMENSION” in the command line and select the objects to be dimensioned. Then, specify the location and type of dimension. The MTEXT command adds multiline text to your drawing.



Part Drawing



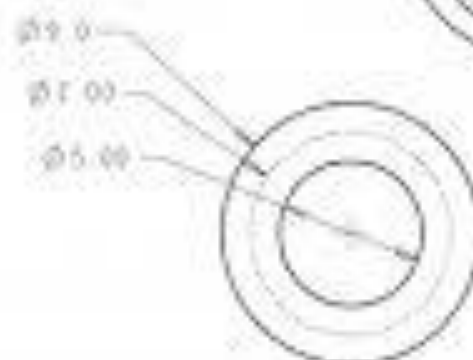
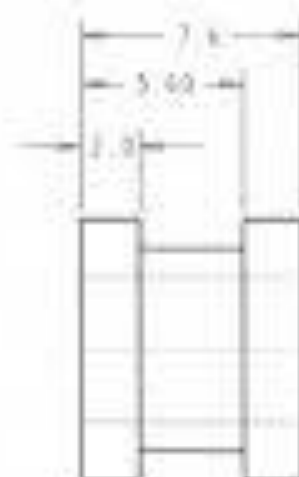
Assembly Drawings

- Assembly Drawings are those drawings which shows an entirety of a machine or system with all its components located and identified. The purpose of an assembly drawings is item identification, labeling the sequence for assembly and sometimes to even mention standard requirements



Satellite Gearing Mechanism

Created for: *Computer Aided Design*



All dimensions in mm

DESIGNED BY REVIEWED BY DATE: 11/11/11		CHECKED BY DATE: 11/11/11		McGill University	
PROJECT NAME PLATE 1		PROJECT NO. 11/11/11		PLATE 1	
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Chapter -3

Geometrical Models and modelling
techniques

Geometrical solid models

- In geometric solid modeling, the boundary representation ("B-Rep") method captures the details of an object's surfaces. B-Rep represents the solid by specifying its boundaries, including faces, edges, and vertices.



HEXAGONAL PYRAMID



CUBOID



CYLINDER



RING



HEXAGONAL PRISM



SPHERE



TRUNCATED CONE



DODECAHEDRON



SQUARE PYRAMID



OCTAHEDRON



CONE



PENTAGRAMMIC PRISM



BUCKYBALL



CUBE



TRIANGULAR PRISM



TORUS



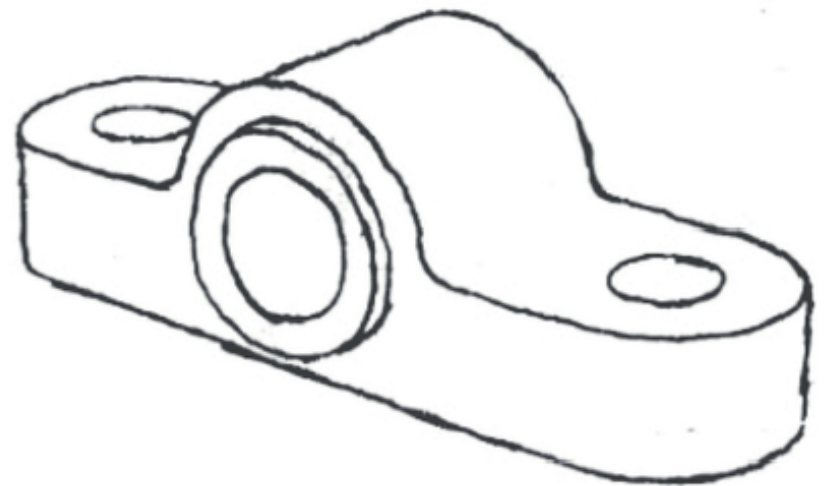
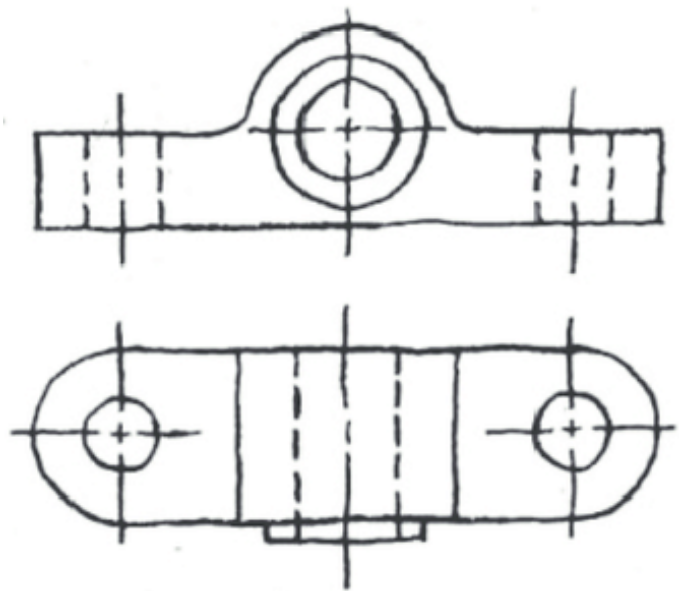
ICOSAHEDRON



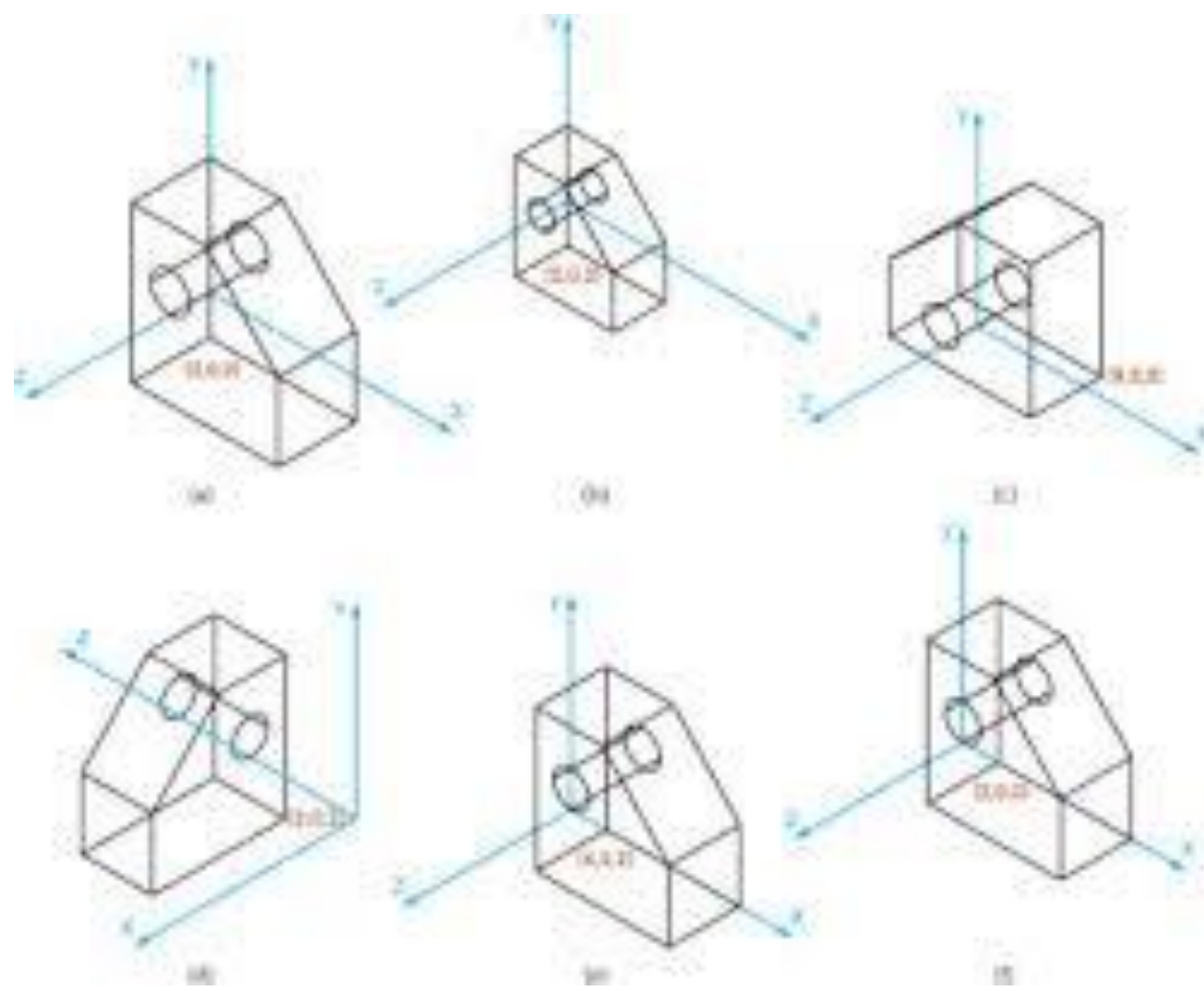
HALF-SPHERE

2D AND 3D

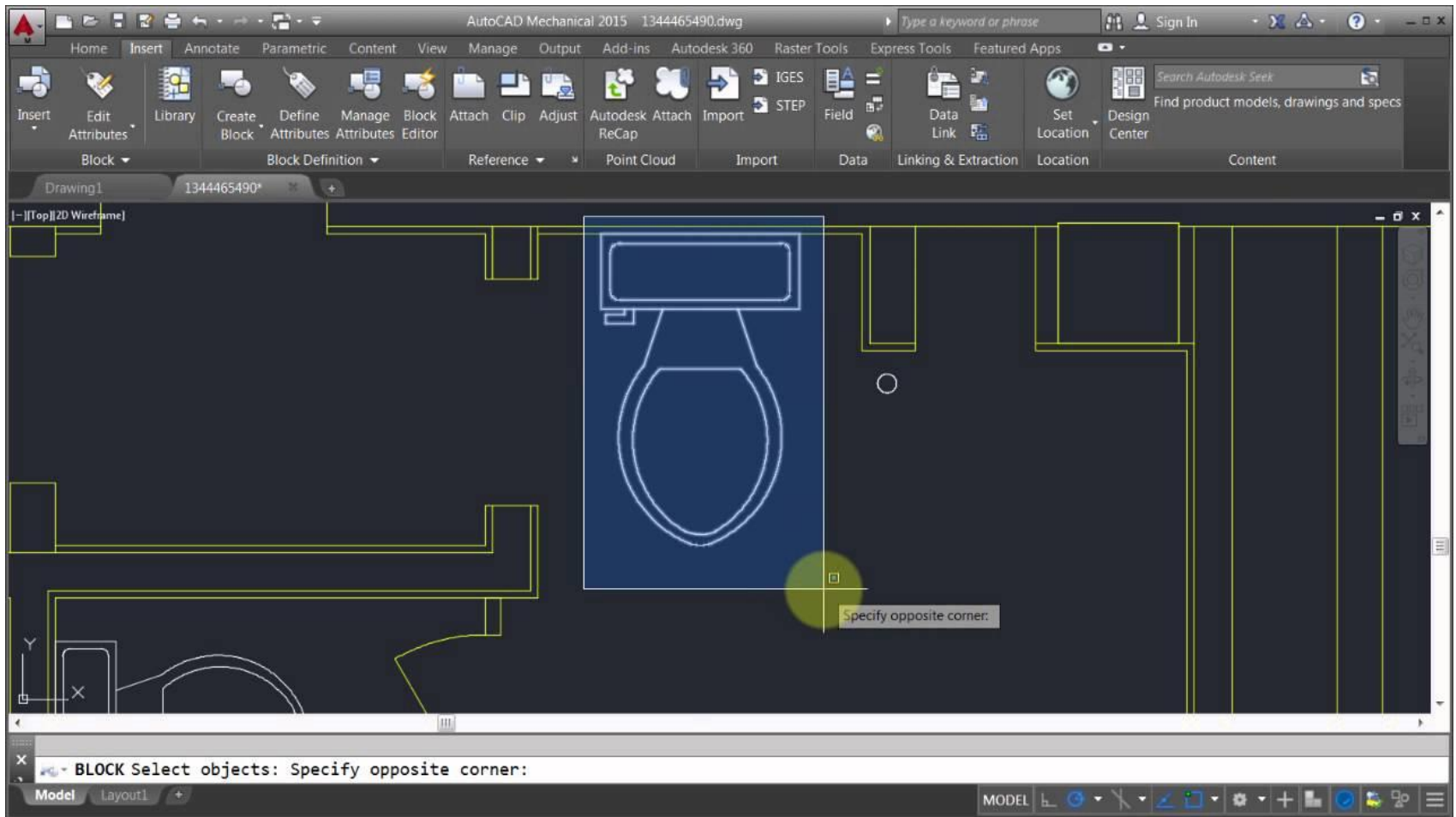
- In terms of design, 2D CAD drafting is the process of using software to draw 2D technical plans or outlines for a product, building, part or other types of object. By contrast, 3D CAD modeling is the process of using software to create a mathematical representation of a 3D object or shape.

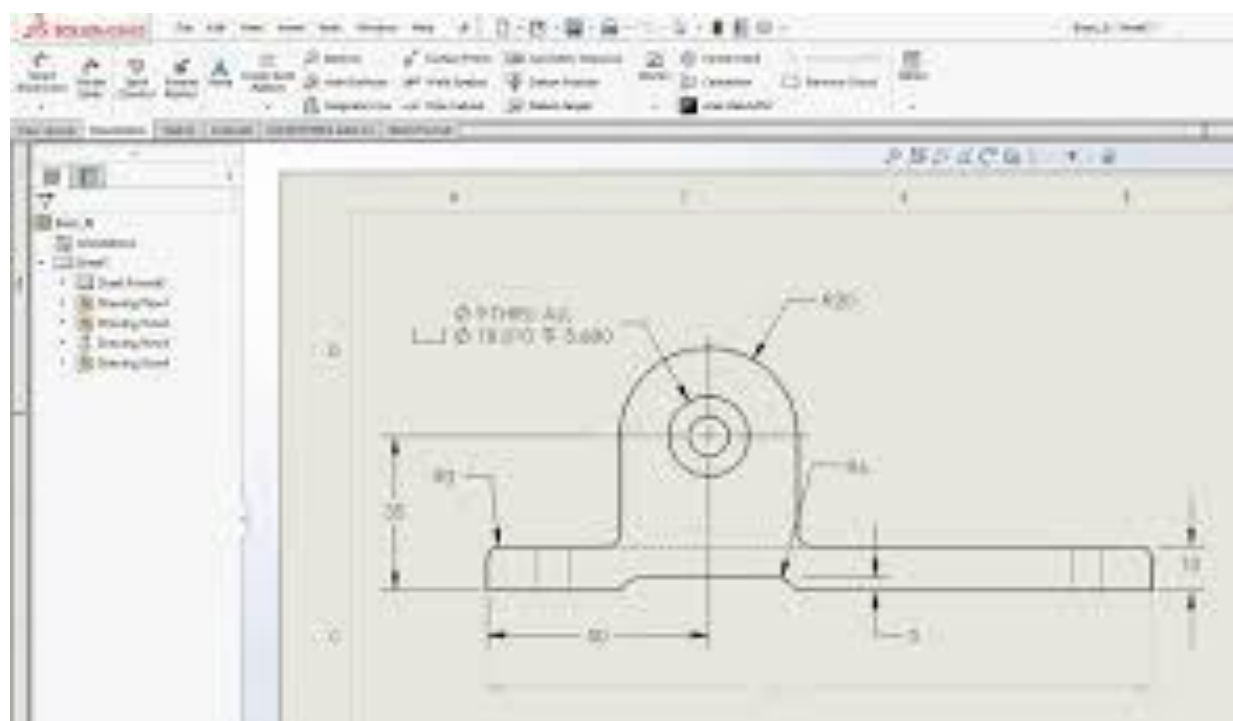


- **3-D Transformation:** In very general terms a 3D model is a mathematical representation of a physical entity that occupies space. In more practical terms, a 3D model is made of a description of its shape and a description of its color appearance. 3-D Transformation is the process of manipulating the view of a three-D object with respect to its original position by modifying its physical attributes through various methods of transformation like Translation, Scaling, Rotation, Shear, etc.

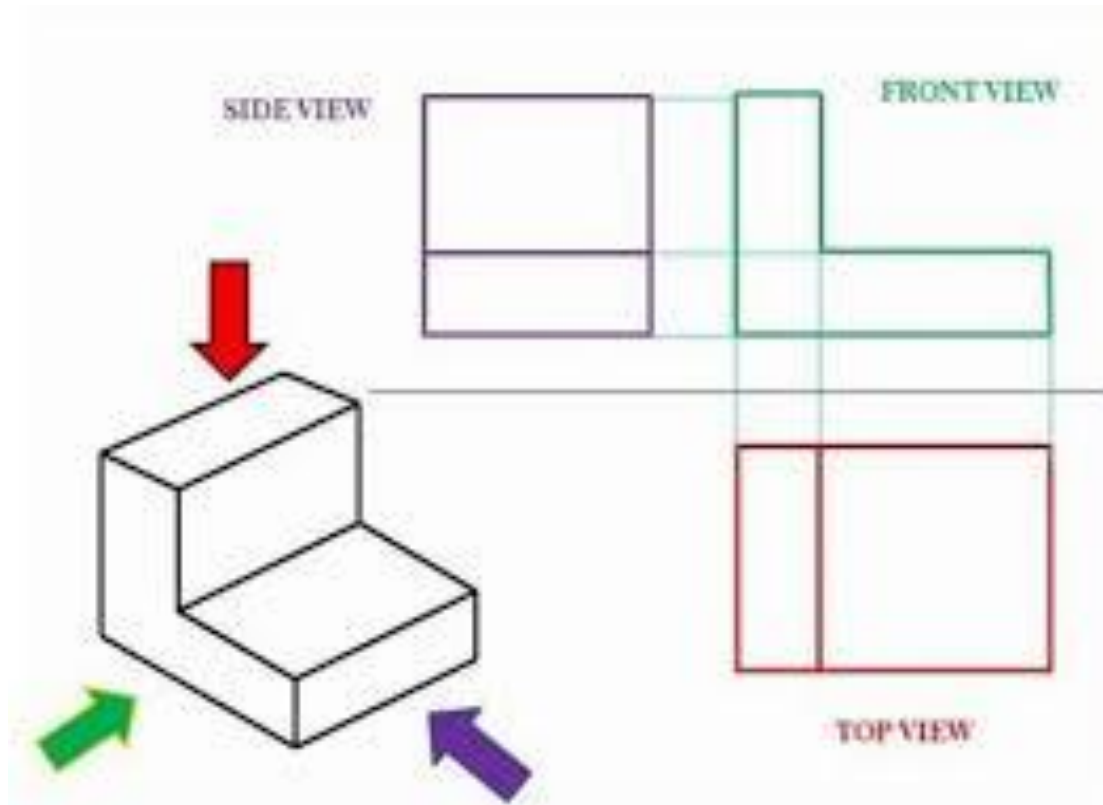


Commands

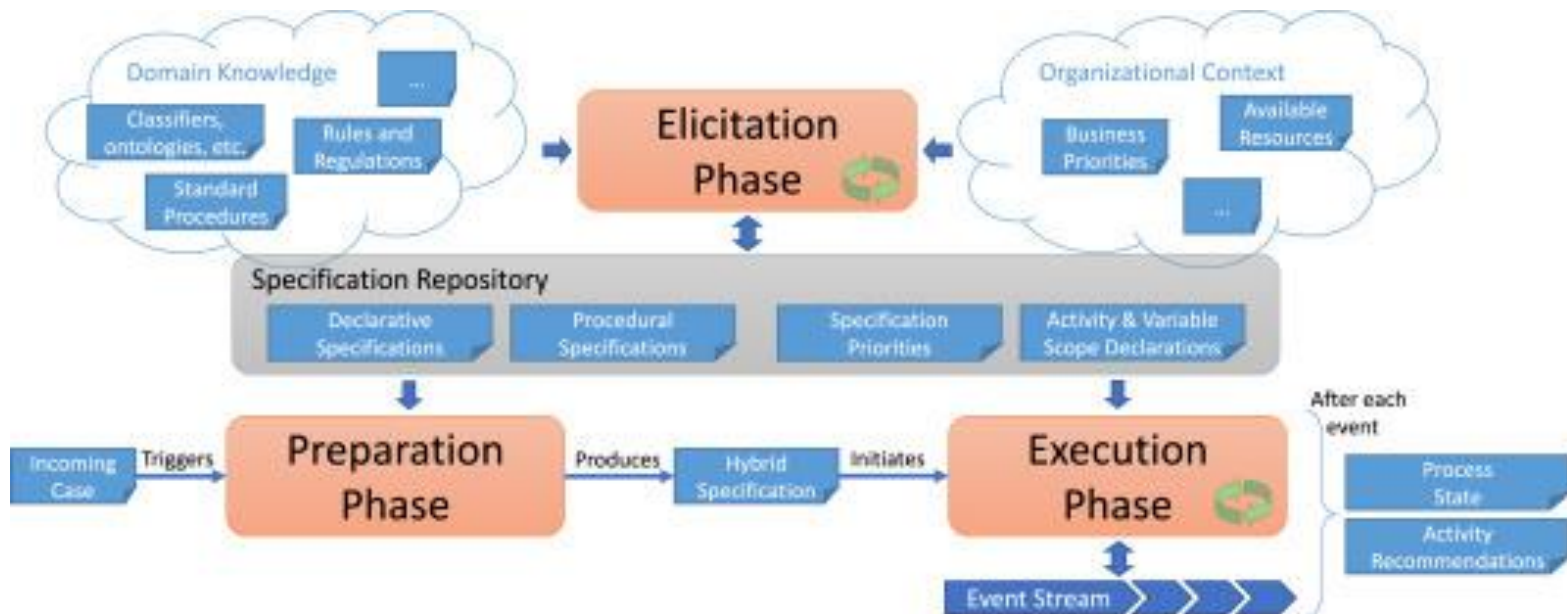




View sets



CGS and HYBRID MODELING



Analytical and Synthetic approaches

Analytic Vs Synthetic

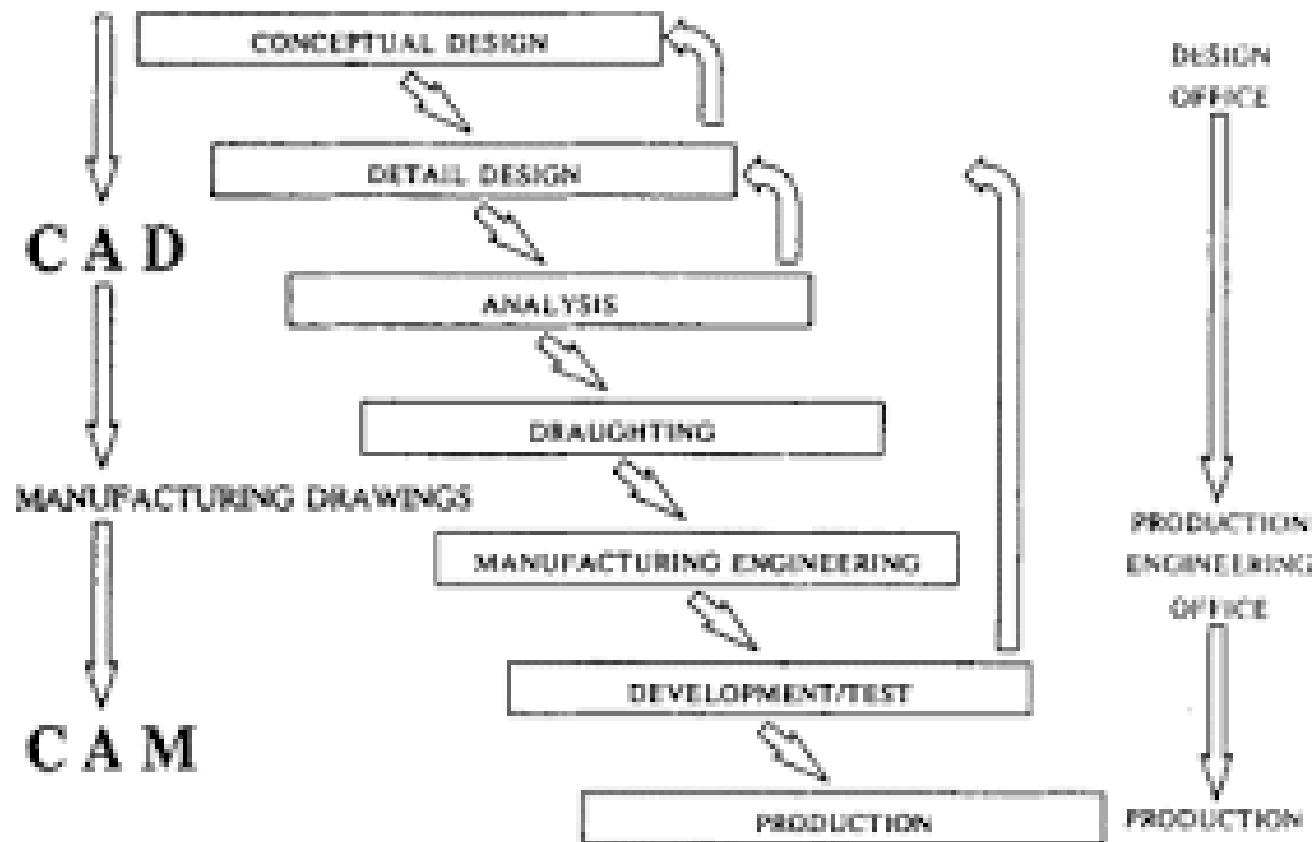
Analytic Method	Synthetic Method
Meaning: Analysis means breaking up into components	Meaning: Synthesis means combining the elements to get something new.
Leads from: Unknown to known, Conclusion to hypothesis, Abstract to concrete, Complex to simple	Leads from: Known to unknown, Hypothesis to conclusion, Concrete to abstract, Simple to complex
Method: A method of discovery and thought. A psychological method	Method: A method for the presentation of discovered facts. A logical method
Time: Lengthy, laborious and time consuming	Time: Short, concise and elegant.
Learning: Encourages meaningful learning	Learning: Encourages rote learning
Encourages: Encourages originality of thinking and reasoning	Encourages: Encourages memory work
Thinking: Process of thinking	Thinking: Product of thinking
Participation: Active participation of the learner	Participation: Learner is a passive listener
Sequence: Valid reasons to justify every step in the sequence.	Sequence: No justification for every step in the sequence.

Chapter-4

Computer Aided Manufacturing
(CAM).

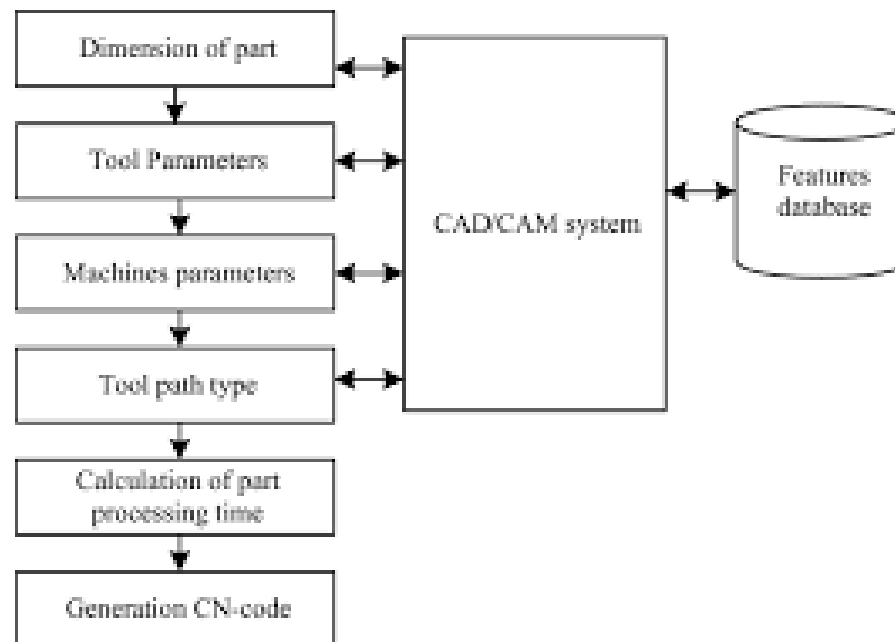
CAM

- Computer-Aided Manufacturing (CAM) is a critical aspect of modern manufacturing processes. It involves the use of computer software to control machine tools and related machinery in the manufacturing of workpieces. This technology is essential in industries where precision and efficiency are paramount



CAD/CAM Database

- With the advent of the CAD and CAM software there has been integration of designing and manufacturing processes. Just like computer aided designing (CAD) we have concept of computer aided manufacturing (CAM). CAD software enables direct link between CAD and CAM.
- On its part CAD enables automation of designing, while CAM enables automation of manufacturing processes. The combination of CAD and CAM enables automated transition from designing to manufacturing. For the product that has been designed using the CAD software on computer, all the process planning and management of the manufacturing operations for the manufacture of the product can be done by the computer systems. All the data from the CAD systems can be directly used for the CAM systems.
- The database created by the integration of CAD/CAM is also called as manufacturing database. It includes all the data about the product generated during design like shape and dimensions, bill of materials and part lists, material specifications etc. It also includes additional data required for the manufacturing purposes.
- Thus in the integrated CAD/CAM system the two processes of designing and manufacturing are combined together. There is no time gap between the two processes and there is no duplication of efforts required on the parts of designer and the production personnel.

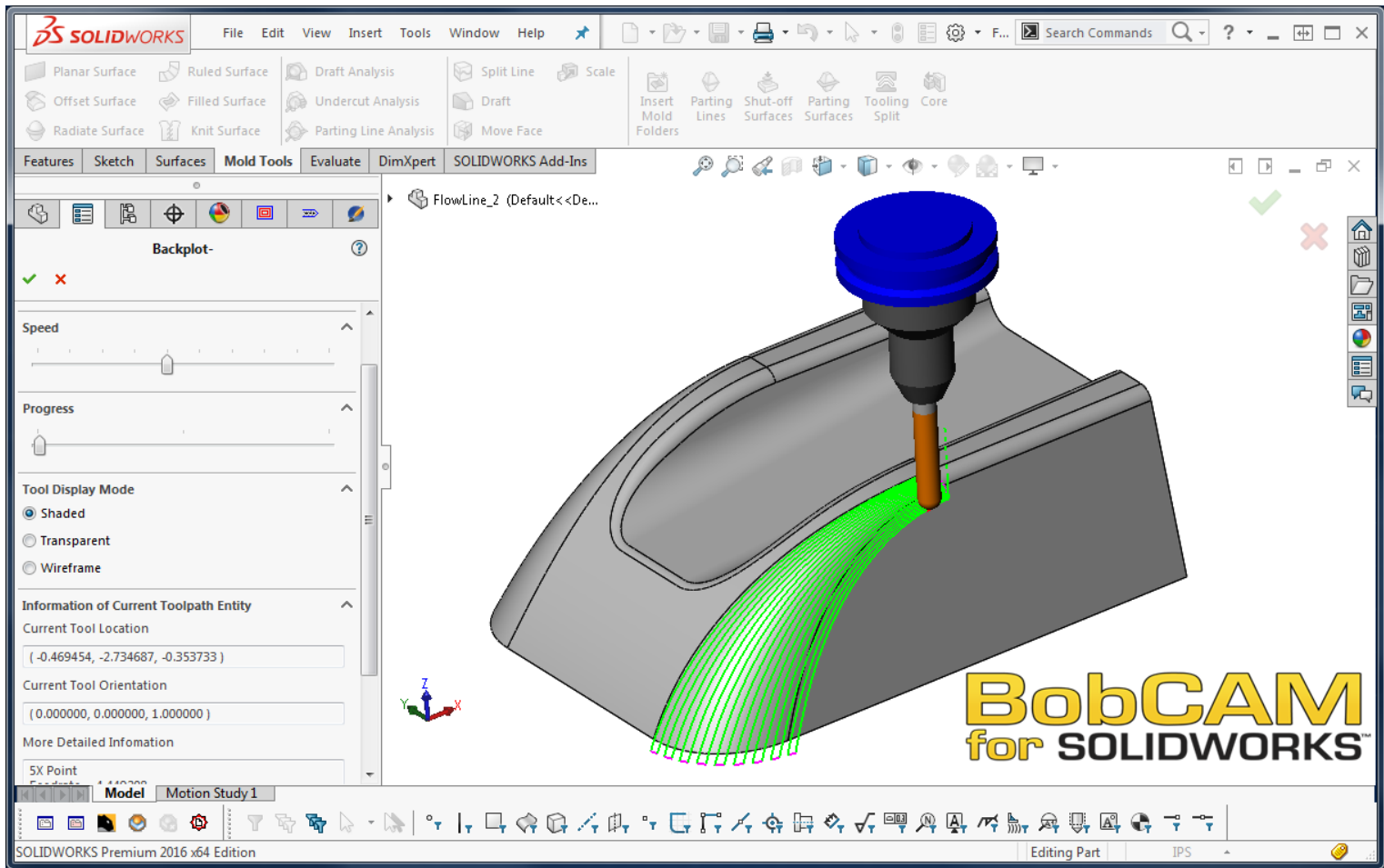


CAD software

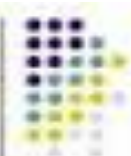
- CAD (computer-aided design) is the use of computer-based software to aid in design processes. CAD software is frequently used by different types of engineers and designers. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models.

CAM software

- Computer Aided Manufacturing (CAM) is the use of software and computer-controlled machinery to automate a manufacturing process. Based on that definition, you need three components for a CAM system to function: Software that tells a machine how to make a product by generating toolpaths.



Need for CAD/CAM



- Design and manufacturing forms the core of engineering.
- To remain competitive in global economy
- New products with enhanced features at competitive costs
- Short lead times and short product lives
- Reduction in product life cycle
- Mass customization – Customer specific changes to satisfy diverse requirements – High flexibility in the manufacturing system
- Reduction in manufacturing cost and delivery time
- Increasing consumer awareness about quality

Elements of CAM system.

- Machine tools are the physical components of CAM systems. They are the machines that carry out the manufacturing operations, based on the instructions provided by the computer program. These can include milling machines, lathes, grinders, and other types of machinery used in manufacturing processes

NC system in CAM.

- CAM is a program or a tool that makes use of numeric control or NC for creating detailed instruction (G-code). This code, once executed, helps the CNC machine perform the required actions like cutting and drilling

NC Part Programming using CAD/CAM

- An advanced form of computer-assisted part programming in which an interactive graphics system equipped with NC programming software is used to facilitate the part programming task.
- The term CAD/CAM means computer-aided design and computer-aided manufacturing.
- In this method the programmer works on a CAD/CAM workstation to enter the machining commands.