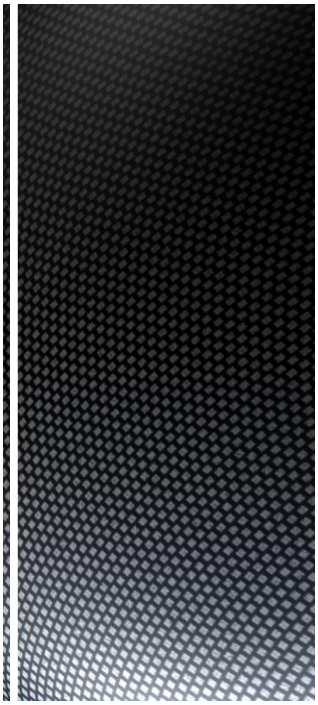


CAD/CAM (21-342)

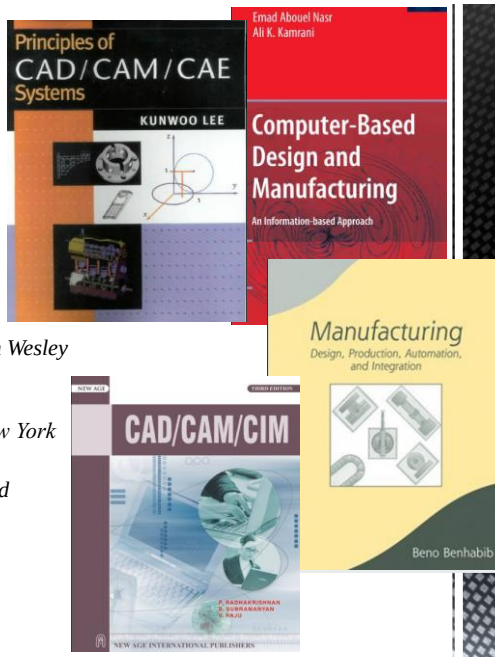
Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 4

Course Description

- *Instructor*
  - *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
  - *Email: FValilai@sharif.edu , Tel: 6616-5706*
  - *Website: Sharif.edu/~fvalilai*
- *Class time*
  - *Saturday- Monday* *10:30-12:00*
- *Course evaluation*
  - *Mid-term* *(25%)*
  - *Final exam* *(40%)*
  - *Quiz* *(5%)*
  - *Exercise* *(30%)*

Course Description *(Continued ...)*



- *Mid-term session:*
  - *Monday: 8th Ordibehesht 1393, 10:30 ~ 12:30*
- *Final Exam:*
  - *Saturday: 24th Khordad 1393, 15:00 ~ 17:30*
- *Reference:*
  - *Lee, Kunwoo; "Principles of CAD/CAM/CAE systems", 1999, Addsion Wesley*
  - *Abouel Nasr, Emad; Kamrani, Ali K.; "Computer-Based Design and Manufacturing: An Information-Based Approach", 2007, Springer, New York*
  - *Benhabib, Beno; "Manufacturing: Design, Production, CAD/CAM, and Integration", 2003, Marcel Dekker Inc, New York*
  - *Radhakrishnan, P.; Subramanian, S.; Raju, V.; "CAD/CAM/CIM", 3rd edition, 2005, New age international (P) limited publishers, New York*

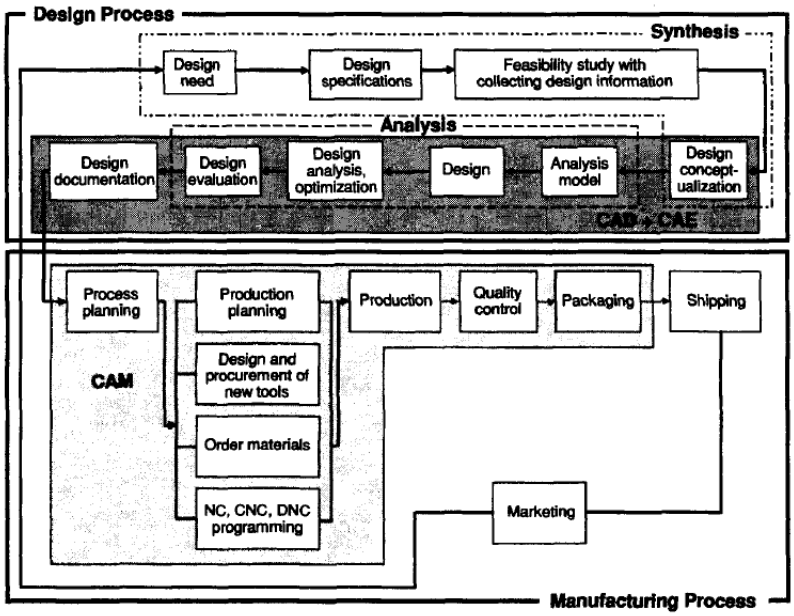
Course Description *(Continued..)*

- *Contents:*
  - *Introduction to CAD/CAM/CAE systems* *(5 sessions)*
  - *Components of CAD/CAM/CAE systems* *(2 sessions)*
  - *Geometric modeling systems* *(3 sessions)*
  - *Optimization in CAD* *(5 sessions)*
  - *Rapid prototyping and manufacturing* *(3 sessions)*
  - *Virtual engineering* *(2 sessions)*
  - *Product Life Cycle Cost Model* *(2 sessions)*
  - *Computer-Based Design and Features/Methodologies of Feature Representations* *(5 sessions)*
  - *Feature-Based Process Planning and Techniques* *(3 sessions)*
  - *Collaborative Engineering* *(2 sessions)*

Course Description *(Continued..)*

- *Contents:*
  - *Components of CAD/CAM/CAE systems* *(2 sessions)*
    - *Hardware components*
    - *Hardware configurations*
    - *Software components*
    - *CAD/CAM systems*

Introduction to CAD/CAM/CAE systems



Components of CAD/CAM/CAE systems

- *3D Modeling in CAD/CAM*
  - *In a CAD/CAM system, the first goal is to create a geometric model of an object.*
  - *Such a model serves as a digital representation, in a computer, that we can use later for a variety of enginee1ing activities such as analysis and manufacturing.*
  - *The representation is well structured in the model database, and the database structured content is stored in the part file of the model.*

Components of CAD/CAM/CAE systems

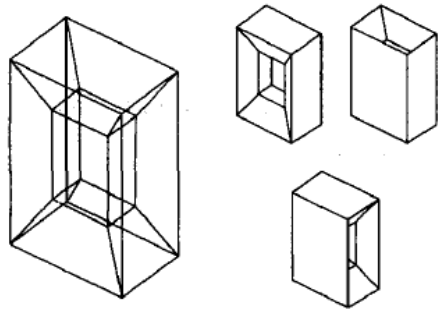
- *3D Modeling in CAD/CAM*
  - *Solid models are what CAD/CAM systems use.*
  - *A solid model is a complete, unique, and unambiguous representation of an object.*
  - *The model resembles the object. An object, such as a cube, has sides (6), edges (12), and comers (8).*
    - *Its corresponding solid model has faces, edges, and vertices to represent its sides, edges, and comers, respectively*

Components of CAD/CAM/CAE systems

- *3D Modeling in CAD/CAM*
  - *While all CAD/CAM systems create parametric solid models, CAD designers can create the models in different ways.*
  - *We identify three modeling approaches that designers can choose from to create solid models.*
    - *Primitives,*
    - *Features, and*
    - *Sketching.*

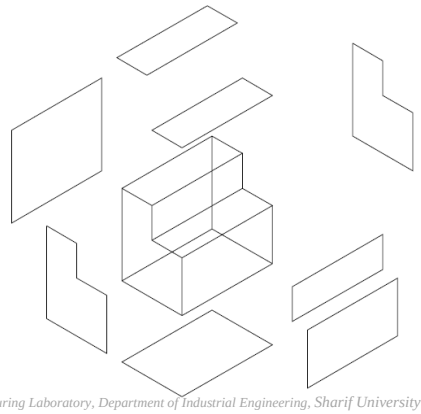
Geometric modeling systems

- *Wireframe modeling systems*
  - *This system represent a shape by its characteristics lines and end points.*
  - *The system uses lines and points to display three-dimensional shapes and allow manipulation of the shapes by modifying the lines and points.*



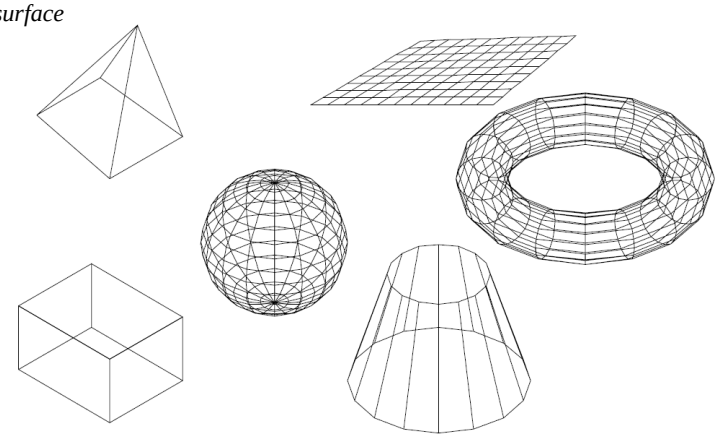
Geometric modeling systems

- *Surface modeling*
  - *In this approach, a component is represented by its surfaces which in turn are represented by their vertices and edges.*



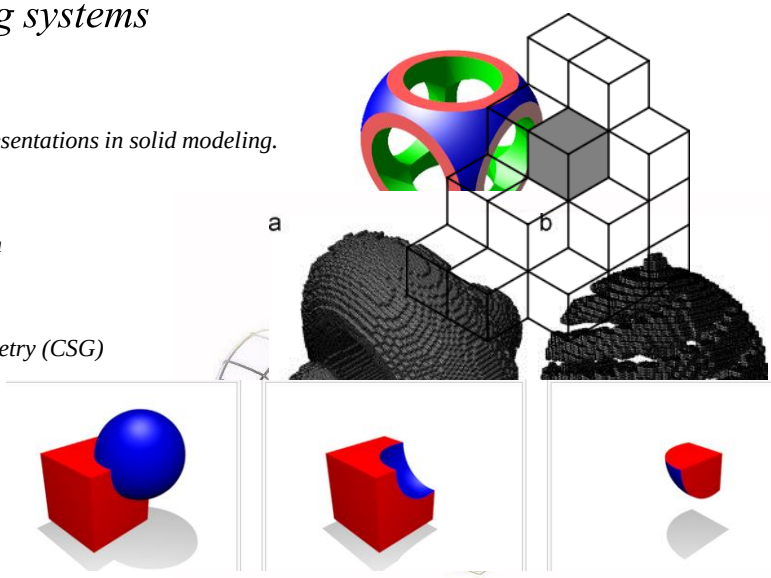
Geometric modeling systems

- *Surface modeling*
  - *Standard surface types available for surface modeling:*
    - *box,*
    - *pyramid,*
    - *wedge,*
    - *dome,*
    - *sphere,*
    - *cone,*
    - *torus,*
    - *dish*
    - *and mesh*



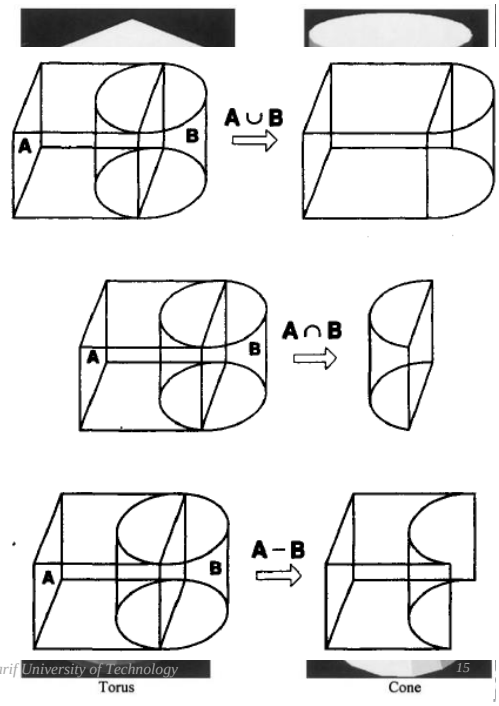
Geometric modeling systems

- *Solid modeling*
  - *There are six common representations in solid modeling.*
    - *Spatial Enumeration*
    - *Cell Decomposition*
    - *Boundary Representation*
    - *Sweep Methods*
    - *Primitive Instancing*
    - *Constructive Solid Geometry (CSG)*



Geometric modeling systems

- *Solid modeling*
  - *Constructive Solid Geometry (CSG)*
  - *In a CSG model, physical objects are created by combining basic elementary shapes known as primitives like blocks, cylinders, cones, pyramids and spheres.*
  - *The Boolean operations like union (∪), difference (–) and intersection ∩ are used to carry out this task.*



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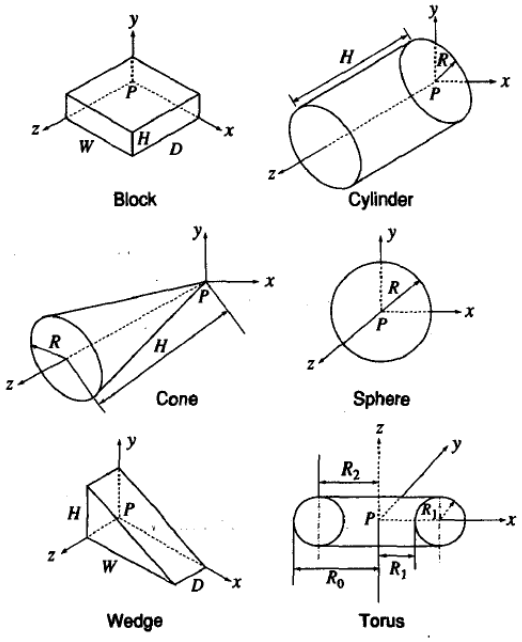
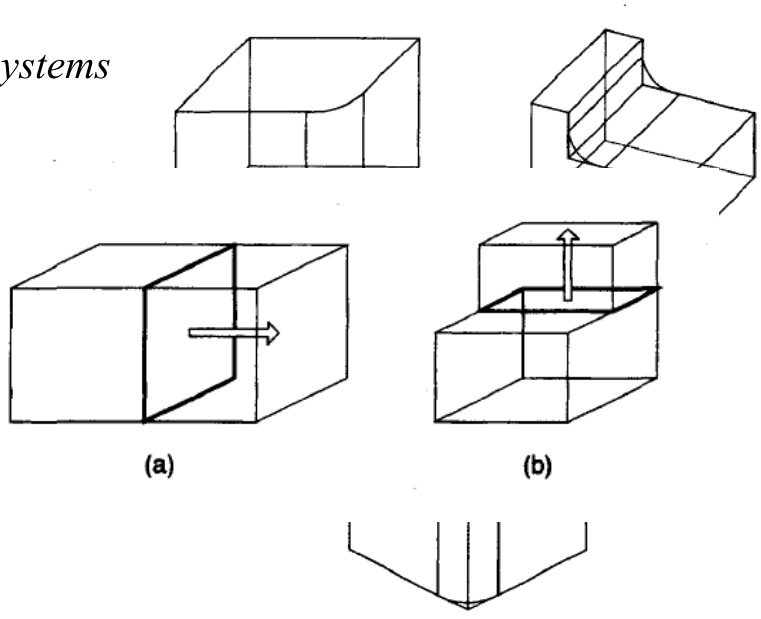


Geometric modeling systems

- *Solid modeling*
  - *Operations*
    - *Boolean operations*
    - *Sweeping*
    - *Skinning*
    - *Rounding*
    - *Lifting*



Geometric modeling systems

- *Solid modeling*
  - *Boundary Representation (B-rep)*
  - *Boundary representation is built on the concept that a physical object is enclosed by a set of faces which themselves are closed and oriented surfaces.*

Geometric entities	--	***Topological entities***
Point	--	*Vertex*
Curve, line	--	*Edge*
Surface	--	*Face*