

# *CAD/CAM (21-342)*

*Advanced Manufacturing Laboratory  
Department of Industrial Engineering  
Sharif University of Technology*

*Session # 13*



## *Course Description*

### ▪ *Instructor*

- *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
- *Email: [FValilai@sharif.edu](mailto:FValilai@sharif.edu), Tel: 6616-5706*
- *Website: [Sharif.edu/~fvalilai](http://Sharif.edu/~fvalilai)*

### ▪ *Class time*

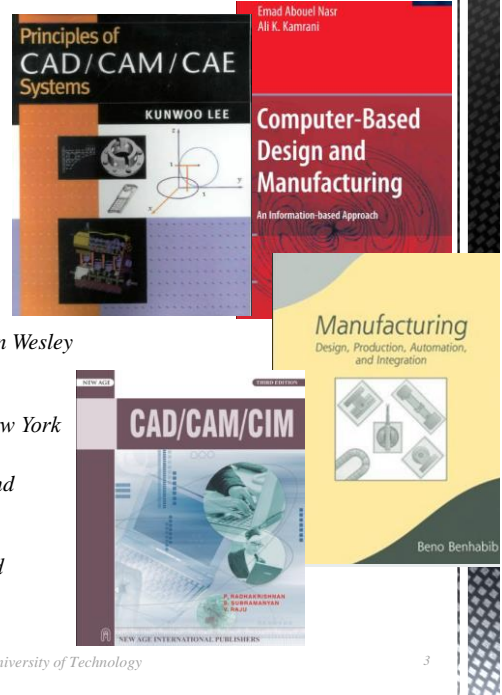
- *Saturday- Monday 10:30-12:00*

### ▪ *Course evaluation*

- *Mid-term (25%)*
- *Final exam (40%)*
- *Quiz (5%)*
- *Exercise (30%)*

## Course Description (Continued ...)

- **Mid-term session:**
  - Monday: 8<sup>th</sup> Ordibehesht 1393, 10:30 ~ 12:30
- **Final Exam:**
  - Saturday: 24<sup>th</sup> Khordad 1393, 15:00 ~ 17:30
- **Reference:**
  - Lee, Kunwoo; "Principles of CAD/CAM/CAE systems", 1999, Addison 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, Automation, 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



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CAD/CAM (21-342), Session #13

3

## 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)

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CAD/CAM (21-342), Session #13

5

## Course Description (Continued..)

### ▪ Contents:

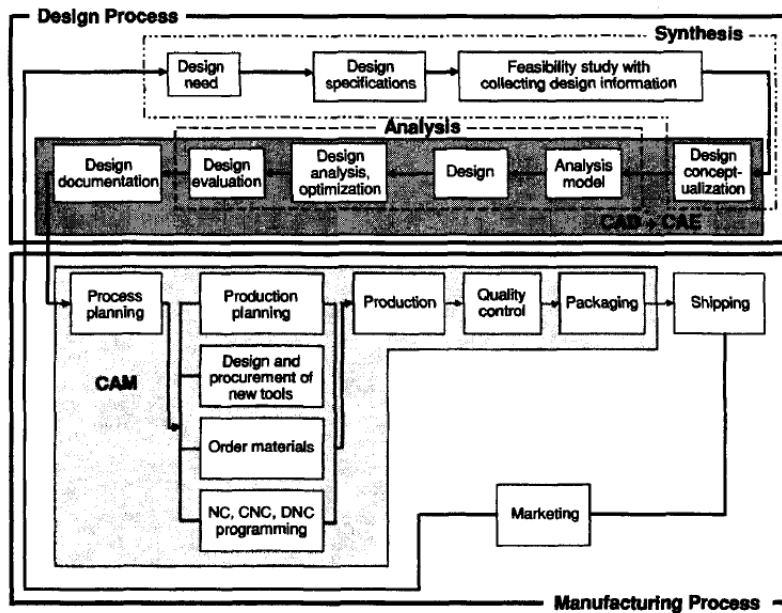
- Rapid prototyping and manufacturing
- RP primitives
- Application of RP

(3 sessions)

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CAD/CAM (21-342), Session #13

6

## Introduction to CAD/CAM/CAE systems



7

## Rapid prototyping and manufacturing

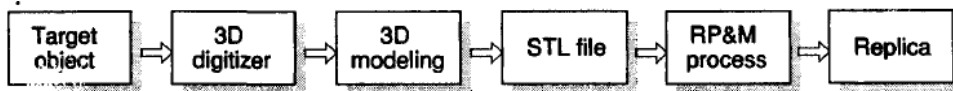
- **RP primitives**
  - *Rapid prototyping' is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data.*
  - *Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology.*
    - *Alternatively, it is also called:*
      - *Layered manufacturing*
      - *3D printing*
      - *Desktop manufacturing*
      - *Solid free form manufacturing*

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CAD/CAM (21-342), Session #13

8

## Rapid prototyping and manufacturing

- **Application of RP**
  - **Reverse engineering**
    - *Reverse engineering is the process of discovering the technological principles of a device, object, or system through analysis of its structure, function, and operation.*
  - *There are two phase in reverse engineering*
    - *The digitizing or measuring of a part and the three dimensional modeling of a part from the digitized data.*
  - *Processing the digitized data into a solid model*



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CAD/CAM (21-342), Session #13

9

## Rapid prototyping and manufacturing

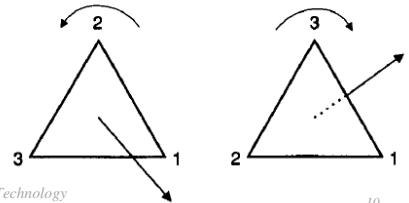
### Application of RP

#### STL format

- The STL file format (.stl) was established by 3D systems in 1987
- An STL file represents an object (tessellated, faceted) as a mesh of connected triangles.

```

solid example
  facet normal 6.89114779E-02 -9.96219337E-01 -5.28978631E-02
  outer loop
    vertex 2.73239994E+01 1.08957005E+01 4.57905006E+01
    vertex 2.81019993E+01 1.09582005E+01 4.56250000E+01
    vertex 2.75955009E+01 1.09116001E+01 4.58456993E+01
  endloop
endfacet
:
:
endsolid example
  
```



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CAD/CAM (21-342), Session #13

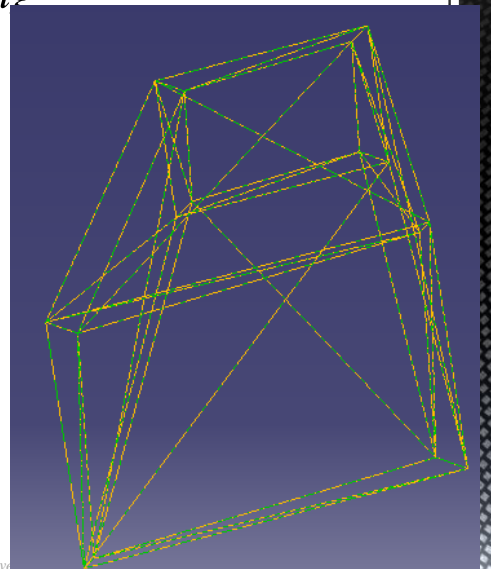
10

## Rapid prototyping and manufacturing

### Application of RP

#### STL format

- The STL file format (.stl) was established by 3D systems in 1987
  - Easy conversion
  - Wide range of input
  - Simple-slicing algorithm
  - Splitting STL models
- Verbosity and data redundancy
- Error due to approximation
- Truncation errors
- Lack of information



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CAD/CAM (21-342), Session #13

11