Course Description

- **Instructor**
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- **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:
  - Benhabib, Beno; “Manufacturing: Design, Production, CAD/CAM, and Integration”, 2003, Marcel Dekker Inc, 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:
  * Computer-Based Design and Features/Methodologies of Feature Representations (5 sessions)
  * Feature-Based Technologies
  * The New Methodology Objectives
  * Variant Process Planning (VPP)
  * Generative Process Planning (GPP)
  * Assembly Planning

Introduction to CAD/CAM/CAE systems
Computer-Based Design and Features

Methodologies of Feature Representations

- Feature-Based Technologies
  - Process planning
    - Generative Process Planning

  * In the generative process planning (GPP) approach, the planning system seeks to synthesize the process plan directly
  
  * For machine-designed objects, the distinctive approach is to perform the planning on the basis of a feature by feature methodology by retrieving candidate processes from the manufacturing knowledge repository,
    selecting the practical processes on the basis of geometric and manufacturing information of the designed objects,
    and merging the selected processes in a proper sequence.
Computer-Based Design and Features
Methodologies of Feature Representations

- Feature-Based Technologies
  - Feature recognition
    - Feature recognition involves the identification and grouping of feature entities from a geometric model.

  - Design by features, or the so-called feature-based design (FBD), uses a library of 2D or 3D features as design primitives on the product modeling level.

  - Features allow the capability of providing additional information useful for process planning.

  - Since features reflect specific manufacturing processes, they assure the parts can be produced.
Computer-Based Design and Features
Methodologies of Feature Representations

* Feature-Based Technologies
  * Feature Recognition Techniques
    * The feature recognition algorithms can be classified by their approaches to the problems as follows:
      * 1. The syntactic pattern recognition approach
      * 2. Logic-based approach
      * 3. Graph-based approach
      * 4. Expert system/artificial intelligence approach
      * 5. Volume decomposition and composition approach
      * 6. 3D feature recognition from 2D features approach

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   CAD/CAM (21-342), Session #18

   IF the input sting is ABCAGHA
   THEN the feature is a countersink hole

A. Pattern primitives  B. Countersink hole  C. Input string
Feature-Based Technologies

Feature Recognition Techniques

The feature recognition algorithms can be classified by their approaches to the problems as follows:

2. Logic-based approach

The logic rules are used with the B-rep representation modeling and the CSG representation modeling approaches for feature recognition.

Each feature can be recognized by a separate rule.

IF

face $F_1$ is adjacent to face $F_2$ and
face $F_1$ is adjacent to face $F_3$ and
face $F_1$ is adjacent to face $F_4$ and
face $F_1$ is adjacent to faces $F_5$, $F_6$, $F_7$, and $F_8$
and
angle between $F_2$ and $F_3$ is < 180 (concave),
and
angle between $F_3$ and $F_4$ is < 180 (concave)

THEN

faces $F_1$, $F_2$, $F_3$, $F_4$, and $F_5$ form a pocket feature

Computer-Based Design and Features
Methodologies of Feature Representations

IF

the Boolean operation is Subtraction, and the dimensions of the subtracted solid primitive are less than the solid model and the subtracted solid primitive is a cylinder

THEN

the feature is a hole
Computer-Based Design and Features
Methodologies of Feature Representations

- Feature-Based Technologies
  - Feature Recognition Techniques
  - The feature recognition algorithms can be classified by their approaches to the problems as follows:
    - 3. Graph-based approach

![Figure 5-4. Representation of vertices, edges, and faces](image)

<table>
<thead>
<tr>
<th>Vertex</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
</tr>
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<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>V2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
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<tr>
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</tr>
</tbody>
</table>

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