ME 473: Advanced CAD and Geometric Modeling

Course description: Advanced parametric and feature based CAD/CAM; mathematical basis for geometric modeling; computational geometry; integration of CAD with engineering flow processes and other software systems.

Number of credits: 3 (2-3)

Course Coordinator: U. Jayaram

Prerequisites by course: ME 316

Prerequisites by topic:

1. Analysis and modeling of engineering problems
2. Numerical and mathematical techniques
3. Calculus
4. Matrix and vector algebra
5. Background in programming

Postrequisites: None

Textbooks/other required materials: Condoor. *Modeling Using Pro/Engineer Wildfire Tutorial and Multimedia CD,* Schroff Development Corporation.

Course objectives:

1. Learn advanced concepts of feature based modeling and parametric modeling
2. Understand the mathematical basis for geometric modeling of curves and surfaces and their relationship with computer graphics.
3. Understand the methods of representation of wireframe, surface, and solid modeling systems.
4. Consider data associativity concepts of CAD/CAE integration; Be familiar with interoperability and data transfer techniques between design and analysis software systems.
5. Learn role of CAD in MDO (Multidisciplinary Design Optimization).
6. Be familiar with collaborative design tools including virtual prototyping, and visualization tools.
7. Understand role of PDM/PLM in an engineering enterprise.
8. Gain experience in design projects involving multiple CAD systems
9. Gain extensive hands-on experience with two commercial CAD systems to gain proficiency in using the systems at advanced levels, migrating and sharing data between systems, and applying the theory covered in this course.

Topics covered:

1. CAD/CAM/CAE in the context of mechanical engineering.
2. Advanced part modeling and assembly modeling; capture of design intent.
3. Coordinate systems and transformations.
4. Representation and manipulation of parametric curves, Hermite curves, Bezier curves; Significance and added functionality provided by B-spline curves.
5. Representation of wireframe, surface, and solid modeling systems.
6. Computational Geometry and Algorithms
7. Data transfer between CAD systems; Data Exchange techniques – STEP, IGES, Feature Based Translations
8. Concepts in Engineering work flow; Role of CAD in MDO (Multidisciplinary Design Optimization)
9. Collaborative design tools
10. PDM/PLM
11. Use of two commercial CAD systems to understand inherent commonalities and differences and to understand issues related to migrating and sharing data between systems,

Expected student outcomes:	1. Understand the role of a CAD/CAM/CAE system in the context of the product life cycle. 2. Be able to represent curves and surfaces using parametric equations. 3. Work with multiple commercial CAD/CAE and supporting systems to represent and solve real engineering problems and work flow issues. 4. Understand the role of CAD and PDM/PLM in MDO and engineering work flow.
Class schedule:	Two 50-minute lecture sessions per week, for one semester
Laboratory schedule:	One 3-hour laboratory session per week, for one semester
Contribution to meeting the professional component:	Engineering Topics
Relationship of course to program objectives:	Meets: 1. School of MME ME educational objectives: 1, 5, 7, 8, 9 2. School of MME ME program outcomes: (c), (e), (f), (g), (i), (j), (k) 3. ABET EC2000, Criterion 3 program outcomes: (c), (e), (f), (g), (i), (j), (k)
Prepared by:	U. Jayaram *Date:* April 9, 2009

Disability Statement:

Reasonable accommodations are available for students who have a documented disability. Please notify the instructor during the first week of class of any accommodations needed for the course. Late notification may cause the requested accommodations to be unavailable. All accommodations must be approved through the Disability Resource Center (DRC) in Administration Annex 205, 335-1566 in Pullman.