

ME 478 – 3 Finite Element Analysis in CAD

Instructor: **Dr. Tsuchin Philip Chu**, E 016, 453-7003, tchu@siu.edu

Office Hours: 11-12 & 2-3 MF & 10-12 T

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Description: Course to cover a multitude of topics in CAD/CAE with emphasis on finite element modeling and analysis. Overview of CAD/CAM/CAE; FEA software; FEA problems including trusses, beams, frames, thermal analysis, and fluid mechanics; design optimization; limitations of FEA. Students are required to use FEA software for homework assignments and projects. *Prerequisites:* ME 302 and ME 475 or consent of the instructor.

Textbooks: “*Finite Element Simulation with ANSYS Workbench 14*,” H.H. Lee, 2012, SDC, www.sdcpublications.com, ISBN: 978-1-58503-725-4.

Class Schedule: 10:00 – 10:50 AM, MWF, Classroom: EGRA 210, Computer lab: EGRA 209

Assignments & Tests: Homework assignments and ANSYS tutorials: 20%
Design Projects: 20%
2-3 tests (written and ANSYS): 30%
Final Exam (comprehensive): written 15%, ANSYS 15%

Grade Distribution: 90 & above: **A**, 80~89.9: **B**, 70~79.9: **C**, 60~69.9: **D**, Below 60: **F**

Course Objectives: The main objective of this course is to assist the students to gain clear basic concepts of finite element modeling and analysis in computer-aided design and engineering (CAD/CAE). This course offers insight to the theoretic aspects of FEA and also covers practical aspects of modeling. Applications to problems in heat transfer and solid mechanics will be made. Both manual calculation and the use of FEA software are expected for assignments and design projects. Students will also learn the concepts and applications of design optimization.

References:

ANSYS Workbench Tutorial Release 14, Kent L. Lawrence, SDC, 2012, ISBN: 978-1-58503-754-4

Finite Element Analysis: Theory and Application with ANSYS, 3rd edition, Said Moaveni, Prentice Hall, 2008.

Building Better Products with Finite Element Analysis, Vince Adams & Abraham Askenazi, OnWorld Press, 1999.

Websites:

<http://www.ansys.com/>

http://www.nafems.org/main_index.html

Course Outline:

1. CAD/CAM Overview
Design Processes and CAD/CAM/CAE - Hardware & Software - Geometric Modeling - Feature-Base Parametric Design
2. Introduction to Finite Element Analysis (FEA)
What is FEA - Historic Development of FEA - Phases of FEA
3. FEA Software
Software Interface - Database and Files - Finite Element Modeling: Pre-processing - Boundary Conditions and Loads - Result Interpretation: Post-processing
4. One-Dimensional Problems
Trusses - One-Dimensional Elements - Heat Transfer Problems - Solid Mechanics Problems
5. Two-Dimensional Problems
2-D Elements - Thermal Analysis - Torsion of Members - Beams and Frames - Plane Stress - Failure Theory
7. Three-Dimensional Problems
Tetrahedral and Brick Elements – Thermal Analysis – Structural Analysis
8. Convergence and Error Estimation
Understanding Convergence – Uncertainties – Error Estimates – Relating Error Estimates to Convergence
9. Design Optimization
Introduction – Theory – Methodology - Integration with FEA

Emergency Procedures. Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website www.dps.siu.edu (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.

Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency. The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.