University of Idaho
ME 404/504 Finite element applications in engineering
Fall Semester, 2016

Objective: Finite element method is an essential tool for the design and research performed in engineering companies and academic institutions. The goal of this course is to introduce students to the use of the finite element method by focusing on a range of engineering applications and employing an interactive commercial finite element code. Students will learn how to solve various problems from several mechanical engineering areas using the commercial software ABAQUS Student Edition. When available, analytical solutions will be compared with the finite element solutions for validation purposes.

Pre-requisites: Engr 320 (or ME 322) and Engr 350; **Co-req:** ME 341 or instructor permission.

Class hours: M W F 8:30 am - 9:20 am, EP 203

Instructor: Dr. Gabriel Potirniche
324Q Engineering-Physics Building
phone: (208) 885-4049
e-mail: gabrielp@uidaho.edu

Office hours: Tue. 2:30 pm-4:00 pm
Thurs. 2:30 pm- 3:30 pm

Textbook: No textbook required.

Suggested references:
1) ABAQUS help manual
2) Paul M. Kurowski, "Finite element analysis for design engineers", SAE International, Warrendale, PA, 2004
3) A.A. Becker, "An introductory guide to finite element analysis", ASME Press, 2004
4) Jacob Fish, Ted Belytschko, "A first course in Finite Elements", Wiley, 2007

Webpage: http://www.webpages.uidaho.edu/~gabrielp/ME404-504/ME404-504.html

Grading:

Homework/Projects	45%
Midterm Exam	25%
Final Exam (comprehensive)	30%

A: 90-100 B: 80-89 C: 70-79 D: 60-69 F: 0-59

Homework: No late homework/projects allowed.

Learning outcomes:

- An understanding of the basic finite element tolls, procedures and method
- An understanding of the mathematical foundation of the finite element method
- Knowledge of the commercial finite element ABAUQS
- An understating on how the governing equations and theories from different engineering fields are implemented in the finite element method
- The ability to solve a wide variety of engineering problems using the finite element method

Course Outline:

1. Introduction to the finite element analysis
2. Mathematical foundations
3. Meshing techniques and modeling steps
4. Solid mechanics applications:
    a. 1D problems:
        i. Trusses (pin connected structures)
        ii. Beams (frames welded at ends)
    b. 2D problems:
        i. Stress concentration problem
        ii. Elastic-plastic deformation of a bar
        iii. Bending of a plate
        iv. Residual stresses in a beam loaded and unloaded in the plastic region
        v. Impact loading
        vi. Fracture mechanics: stress intensity factor at a crack tip
    c. 3D CAD problems
        i. Stress analysis of a 3D component made of an isotropic material
        ii. Analysis of a composite material using anisotropic material models
5. Thermal analysis applications
    a. Heat conduction problem
    b. Heat conduction and convection
    c. Coupled thermal-mechanical analysis
    d. Coupled thermal-electrical analysis
6. Nonlinear problems: stress analysis and manufacturing
7. Modal analysis
8. Buckling

Disability Support Services Reasonable Accommodations Statement:

Reasonable accommodations are available for students who have documented temporary or permanent disabilities. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 306 in order to notify your instructor(s) as soon as possible regarding accommodation(s) needed for the course: Phone 885-6307, email at dss@uidaho.edu, website at www.access.uidaho.edu>

University of Idaho Student Code of Conduct, Article II, Section 1:

Cheating on classroom or outside assignments, examinations, or tests is a violation of this code. Plagiarism, falsification of academic records, and the acquisition or use of test materials without faculty authorization are considered forms of academic dishonesty and, as such, are violations of this code. Because academic honesty and integrity are core values at a university, the faculty finds that even one incident of academic dishonesty seriously and critically endangers the essential operation of the university and may merit expulsion.

University of Idaho Classroom Learning Civility Clause:

In any environment in which people gather to learn, it is essential that all members feel as free and safe as possible in their participation. To this end, it is expected that everyone in this course will be treated with mutual respect and civility, with an understanding that all of us (students, instructors, professors, guests, and teaching assistants) will be respectful and civil to one another in discussion, in action, in teaching, and in learning.

Should you feel our classroom interactions do not reflect an environment of civility and respect, you are encouraged to meet with your instructor during office hours to discuss your concern. Additional resources for expression of concern or requesting support include the Dean of Students office and staff (5-6757), the UI Counseling & Testing Center's confidential services (5-6716), or the UI Office of Human Rights, Access, & Inclusion (5-4285).