

ME 472: Finite Element Methods in Design

<i>Course description:</i>	Design of selected mechanical systems components using finite element analysis.
<i>Number of credits:</i>	3
<i>Course Coordinator:</i>	H.M. Zbib
<i>Prerequisites by course:</i>	ME 316
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none">1. Basic strength of materials2. Failure theories applied to the prevention of machine element failures
<i>Postrequisites:</i>	None
<i>Textbooks/other required materials:</i>	Fish, J., <i>A First Course in Finite Elements (with CD)</i> . Wiley, 2007.
<i>Course objectives:</i>	<ol style="list-style-type: none">1. Understand basic finite-element theory, computer implementation of this theory, and its practical applications2. Understand finite-element analysis modeling and model verification techniques3. Be able to develop and use appropriate assumptions and boundary conditions for the modeling of industrially realistic problems encountered in design and manufacturing4. Be able to compose well-written and organized reports detailing the modeling effort including all assumptions, results, and verification efforts5. Be able to critically analyze engineering problems and develop reasonable models to simulate them
<i>Topics covered:</i>	<ol style="list-style-type: none">1. Vector-matrix algebra2. Truss analysis3. Variational and weighted residual formulations4. Stress and structural analyses5. Isoperimetric elements and quadrature6. Transient and dynamic analysis
<i>Expected learning outcomes:</i>	<ol style="list-style-type: none">1. Construct accurate finite-element models of various components loading scenarios, and processes2. Develop appropriate engineering assumptions and their finite element implementation to allow components and/or processes to be modeled3. Refine and adapt the finite-element mesh, boundary conditions, and all relevant loads for a given thermal/mechanical system

4. Demonstrate an ability to extend finite-element modeling to include non-traditional problems encountered in design and manufacturing such as time-dependent and non-linear problems
 5. Demonstrate the ability to use existing analytical and approximate methods to verify their finite-element models and results
 6. Clearly and effectively communicate their modeling efforts and results in written form
 7. Critically analyze their assumptions, methods, and results
- Class schedule:* Three 50-minute lectures sessions per week, for one semester

Laboratory schedule: None. (A computer laboratory with Unix workstations is available for the students where they can use the finite elements software ANSYS for their assignments and class projects.)

Contribution to meeting the professional component: Engineering Topics

Relationship of course to student outcomes: Meets:

1. School of MME ME educational objectives: 1, 2
2. School of MME ME program outcomes: 1, 2, 6, 7
3. ABET EC2019, Criterion 3 program outcomes: 1, 2, 6, 7

Prepared by: Andrea Butcherite and H.M. Zbib *Date:* May 30, 2018

POLICIES

A. Reasonable Accommodation (the nature of the particular course determines which one applies):

- **Pullman Campus.** Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.
- **WSU Online Course.** Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (<http://accesscenter.wsu.edu>), Spokane (<http://spokane.wsu.edu/students/current/studentaffairs/disability/>), Tri-Cities (<http://www.tricity.wsu.edu/disability>), Vancouver (<http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services>).

B. Academic Integrity

WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students can be found at <http://conduct.wsu.edu>.

C. WSU Safety

WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, <http://safetyplan.wsu.edu>. It is highly recommended that you visit this web site as well as the University emergency management web site at <http://oem.wsu.edu/> to become familiar with the information provided.