Advanced Topics in Finite Element Method

MECHENG 8038

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
State of the art advances in various areas of finite element methods covering a range of topics including element stability, time integration methods, and adaptive methods.

Prerequisites and Co-requisites:
Prereq: 7068 (768) or equiv, or Grad standing in MechEng, or permission of instructor.

Course Goals / Objectives:
- The objective of this course is to expose students to state of the art advances in various areas of the finite element methods
- Be introduced to element stability and hourglass control
- Learn about time integration methods and adaptive methods for linear and nonlinear problems
- Explore the use of mixed and hybrid element technology as well as eigen-value problems and other state of the art advances

Course Topics:
- Introduction and overview of the Finite Element Method
- Patch tests and benchmark problems
- Element Stability: volumetric and shear locking, Babuska Brezzi (BB) condition, reduced and selective integration techniques, stiffness matrix rank and rank deficiency, spurious singular modes, hourglass control
- Time integration procedures: survey of algorithms, implicit and explicit methods, time step selection (stability, consistency, convergence, accuracy and stability), Mass Lumping.
- Mixed and Hybrid Methods: mixed variational principles, Hu-Washizu stabilization, assumed stress hybrid method, assumed strain variational methods
- Adaptive Methods: p-, h-, and r-adaptivity, error indicators, residual, global and local projection, strategies for adaptive analysis

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Designation:
Elective