Applied Finite Element Technology (3 Credits)
应用有限元技术

Instructor	Kamran Behdinan, MIE Dept, University of Toronto; behdinan@mie.utoronto.ca
Synopsis	The computational aided engineering methods are extensively used in real-life engineering applications and industry. Techniques such as finite element method are very versatile and frequently indispensable part of engineering analysis and design. These methods are now widely used in practically all branches of engineering including the analysis of structures, solids, and fluids. In this introductory course, you will develop an understanding for the basis of the commonly used computational methods in mechanical systems analysis and design. Modeling of mechanical engineering problems using finite element method will be discussed. You will also have an opportunity to use finite element for projects.
Offering	2014 Summer Semester
Audience	Year 3 & 4 Undergraduates and Graduate Students
Classroom	Room xxx, Teaching Bldg. No. XX, Peking University
Schedule	Class: 1-4 PM, M-F, July 7–25, 2014; Final Exam: 1-4 PM, July 26, 2014

Objective

To develop an understanding of finite element (FE) method and its application to real-life engineering problems. You will learn the three phases of FE process, and element development/discretization techniques. At the end of the course you will be able to develop finite element models and obtain solutions for linear and some nonlinear practical engineering problems.

Topics

1. ***Review the general steps of the Finite Element Method (FEM)***: Applications and advantages of the FEM, role of the computer and computer programs for the FEM.
2. ***Formulation of the FEM, linear analysis in solid and structural mechanics***: Formulation of the displacement-based finite element method, Convergence of analysis results, Incompatible and mixed finite element models.
3. ***Formulation and calculation of isoparametric FE matrices***: Isoparametric derivations of continuum elements, Formulation of structural elements, Numerical integration.
4. ***FE analysis of non-structural problems***: Heat transfer analysis, analysis of field problems, Analysis of viscous incompressible fluid flows.
5. ***Solution of equilibrium equations in static analysis***: Direct solutions using algorithms based on Gauss elimination, Iterative solution methods, Solution of nonlinear equations.
6. ***Solution of equilibrium equations in dynamic analysis***: Direct integration methods, Mode superposition, Analysis of direct integration methods, Solution of nonlinear equations in dynamic analysis.
7. ***Solution methods for eigenproblems***: Vector iteration methods, Transformation methods, Polynomial iterations and Sturm sequence techniques.
8. ***Implementation of the FEM.***

References

1. D. L. Logan, *The First Course in the Finite Element Method*, 5th Edition, SI; Cengage Learning (2012).
2. K. J. Bathe, *Finite Element Procedures*; Prentice Hall (1996).
3. R.D. Cook, D.S. Malkus, M.E. Plesha, R.J. Witt, *Concepts and Applications of Finite Element Analysis*, 4th Edition; John Wiley & Sons (2002).

Grading

Homework Assignments	20%
Project Assignment	30%
• *Interim Project Assessment* (10%)	
• *Final Project Assessment* (20%)	
Midterm Exam	10%
Final Exam	40%
Total	**100%**