ME 690/ME 790 **Fall/2011**

Computational Structural Mechanics Software and Applications

Instructor: Jong-Eun Kim, Ph.D., Research Associate Professor
Department of Mechanical Engineering, UAB
Office hour: TTH 3:15-4:15 pm (or by appointment)
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URL : http://www.eng.uab.edu/me/Faculty/jkim/

Class meets: **Tuesday Thursday 2:00-3:15 pm at TBA**

Textbook: Not required

Recommended references:

1. K. J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Inc.
2. D.T. Greenwood, Principles of Dynamics, Prentice-Hall, Inc.
3. LS-DYNA3D Theory and user manuals, 2005
4. MADYMO Theory and user manuals, 2010
5. Recent journal articles (will be distributed in the class)

Prerequisites : None. Fundamental of solid mechanics and dynamics are recommended.

Course description:

This course provides the fundamental concepts, formulations, modeling, and applications of finite element method and rigid body dynamics to solve engineering problems related to structural mechanics. Topics include finite element formulation and modeling to perform impact simulation using a non-linear explicit finite element code, LS-DYNA3D, and rigid body dynamics formulation and application using worldwide standard software for vehicle crash and occupant safety analysis, MADYMO. This course also considers hybrid methodologies to integrate finite element and rigid body models to efficiently analyze some specific problems. Application area includes computational biomechanics to investigate injury mechanisms of human body under dynamic loading conditions as well as classical engineering analysis.

Course outline:

- Basics of finite element method
- Analysis of discrete and continuous systems
- Formulation of structural elements and constitutive relations
- Static vs. dynamic analysis and implicit vs. explicit integration
- Contact-impact algorithms
- Finite element modeling using a pre-processing software, HyperMesh (Altair)
- Impact simulations using LS-DYNA3D (LSTC) and data analysis
- Basic concepts and kinematics/dynamics of rigid body motion
- Restraints and contact interaction of rigid multibody system
- Human dummy model and injury analysis
- MADYMO model development using a pre-processing software, Visaul-SAFE (EASi)
- Crash simulations using MADYMO (TASS) and data analysis

Grading: 30 % Homework and computer assignments
30 % Exams 40 % Final project
A (90% to 100%), B (80% to 89%), C (70% to 79%), F (0% to 69%)