MFG-513 Advanced Topics in Finite Element Analysis

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Instructor:	Eralp Demir	**Time:**	
Email:	eralpd@sabanciuniv.edu	**Place:**	Sabanci University

Office Hours: After class, or by appointment, or post your questions in the website of the class.

Main References:

- Robert D. Cook, David S. Malkus, Michael E. Plesha and Robert J.Witt, *Concepts and Applications of Finite Element Analysis*, John Wiley & Sons Inc., 2002.
- M. Asghar Bhatti, *Advanced Topis in Finite Element Analysis of Structures*, John Wiley & Sons Inc., 2006.

Objectives:
Objective of this course is to teach fundamentals of finite element methodology with numerical implementations and applications.

Prerequisites: MFG-512 or equivalent solid mechanics background

Tentative Course Outline:

1. Introduction to Matlab: Matrix and tensor operations, basic coding, important built-in functions
2. Review of Finite Element Method: Discretization of equilibrium equation, shape functions, solution procedure for linear problems, 1D FEM example
3. Analysis of Elastic Solids: General form of finite element equations, 2D & 3D isoparametric elements, interpolation of fields, evaluation of line - area and volume integration, numerical integration by Gauss-Quadrature, constitutive equations, computation of stresses
4. Plates and Shells: Basis for composite mechanics, Bogner-Fox-Schmidt rectangular and triangular plate elements, shell elements, implementation of orthotropic material properties, laminate mechanics
5. Heat transfer problems: Thermal proplems, energy balance and its discretization, solution of steady-state and transient heat problems
6. Non-linear Finite Element Analysis
   (a) Small-Strain Plasticity - Material Non-linearity: Isotropic plasticity
   (b) Geometrical Non-linearity: Large Displacement Theory
   (c) Large-Strain Plasticity - Material & Geometric Non-linearity
   (d) Crystal Plasticity

Computer Programmes: Matlab, MSC MARC

Grading Policy: Homeworks (40%), Project (30%), Final (30%).

Class Policy:

- Regular attendance is essential and expected.