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

Main References:


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 bar element example, truss elements (2D)
   
   (a) 1D bar elements
   (b) Truss elements
   (c) Beam elements

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

   (a) Triangular (3-noded, 6-noded)
   (b) Quadrilateral (4-noded, 8-noded, 9-noded)
   (c) Tetrahedron (4-noded, 10-noded)
   (d) Hexahedron (8-noded, 20-noded, 27-noded)
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


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

7. Mesh-less methods

**Computer Programmes:** Matlab, MSC MARC

**Grading Policy:** Assignments (20%), Project (30%), Midterm (20%), Final (30%).

**Class Policy:**
- Regular attendance is essential and expected.