

# COMPUTATIONAL MECHANICS

ES 536

## ENERGY METHODS IN ENGINEERING

A review of the equations of mechanics, kinetics, kinematics, constitutive equations, boundary value problems of mechanics, equations of bars, beams, torsion and plane elasticity. Energy and variational principles: preliminary concepts, calculus of variations, virtual work and energy principles, energy theorems in structural mechanics. Stationary variational principles, Hamilton's principle, applications. Variational methods of approximation: Ritz, weighted residual methods: Galerkin, Least squares, Collocation, Subdomain, Kantorovich, Trefftz methods, Finite Elements method and meshless methods (applications to elastic rods, structural systems, elastic plates and shells). Stability: columns, beam-columns, frames, plates.

- References:**
1. Energy and Variational Methods in Applied Mechanics, J. N. Reddy, 1984
  2. Energy Methods in Applied Mechanics, H. L. Langhaar, 1962
  3. Solid Mechanics: A Variational Approach, Clive L. Dym, Irving H. Shames, 1973 McGraw-Hill
  4. Variational Methods in Elasticity and Plasticity, Washizu, K., 1982, 3<sup>rd</sup> edition, Pergamon Press, New York.
  5. Methods of Applied Mathematics, F. B. Hildebrand, 2nd edition, 1965 Prentice-Hall, Inc.

**This course is a fundamental course for the numerical methods in computational mechanics, such as Finite Element Method.**

**FIRST MEETING:** 21.02.2012, 08:40 on Tuesday, MM321.

**Contact:** Zülfü Aşık, Department of Engineering Sciences, Office: MM903, Phone: 2390  
e-mail: azulfu@metu.edu.tr

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