

# AE-6104: Computational Mechanics

## 1. Course Summary

This course focuses on the development of finite element methods for linear, static structural analysis. The basic tools of the finite element method are described and the formulation of various structural elements is discussed.

## 2. Topics to be covered in this course

1. Displacements based elements for structural mechanics. Displacement and strain interpolation matrices. The stiffness matrix. The load vector.
2. The assembly and solution processes.
3. Requirements for convergence. The patch test.
4. Natural coordinates. Triangular and tetrahedral elements.
5. The isoparametric formulation. Coordinate transformations. Gaussian quadrature. Higher order elements. Full and reduced integration.
6. Stress recovery procedures.
7. The active column solver.
8. Enforcement of constraints: linear constraints, Lagrange multipliers.
9. The locking phenomenon.
10. Formulation of beam and plate Bending elements.

## 3. Reference books

The following reference text books are useful sources of information:

Cook, R.D., Malkus D.S., Plesha, M.E., **Concept and Applications of the Finite Elements Method**. John Wiley & Sons. 1989. (TA646.C66)

Bathe, K.J., **Finite Element Procedures**. Prentice Hall, 1996. (TA347.F5B36)

Hughes, T.J.R., The Finite Element Method, **Linear Static and Dynamic Finite Element Analysis**. Prentice Hall, 1987. (TA347.F5H84)

Reddy, J.N.: **Energy and Variational Methods in Applied Mechanics with an Introduction to the Finite Element Method**. John Wiley & Sons, 1984. (TA350.R39)

Shames I.H. and Dym, C.L.: **Energy and Finite Element Methods in Structural Mechanics**. Hemisphere Publishing Corp., 1985. (TA645.S4794)