

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE7016 - Nonlinear analysis of frame structures

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: To facilitate transition from linear elastic displacement-based structural analysis to nonlinear displacement-based matrix analysis of frame structures – To facilitate understanding of behaviour of frame members and frame structures under nonlinear actions.

Course Content: 1. Introduction to Frame Buildings and Nonlinear Actions Structural Systems and Moment-Resisting Frames Structural Actions and Sources of Nonlinearities in Frame Structures 2. Classical Linear Static Analysis Assumptions and Considerations in Classical Analysis; Coordinate Frames; Slope Deflection Method General Procedure for Linear Elastic Static Analysis Special issues (Real Hinges, Specified Deformation at Supports, Flexible Restraints at Supports) 3. Geometric Nonlinear Static Analysis Effect of Axial Deformation on Bending Effect of Bending on Axial Stiffness Stability and Buckling Solving Nonlinear Systems; General Procedure for Nonlinear Elastic Static Analysis Special Issues (Small Strain and Large Deformation; Effective Length of Frame Members) 4. Material Nonlinear Static Analysis Stress-Strain Relations; Plastic Actions (Lumped Plasticity, Distributed Plasticity) Inelasticity in Frames: Lumped Plasticity Approach General Procedure for Nonlinear Inelastic Static Analysis 5. Combined Geometric- Material Static and Dynamic Nonlinear Analysis History Dependence (Cyclic Loading, Hysteresis rules) Plastic Moment Hinges under Cyclic Loading General Procedure for Nonlinear Inelastic Dynamic Analysis.

Text Books: NIL

Reference Books

- Yang, Y.B. and Kuo, S.R., Theory and Analysis of Nonlinear Framed Structures, Prentice Hall India Private Limited, 1994
- Levy, R. and Spillers, W.R., Analysis of Geometrically Nonlinear Structures, Chapman and Hall, 1995
- Kassimali, A., Matrix Analysis of Structures, Brooks/Cole Publishing Company, 1999
- Menon, D., Advanced Structural Analysis, Narosa Publishing House Pvt. Ltd., 2009
- Nelson, J.K. and McCormac., J.C., Structural Analysis: Using Classical and Matrix Approaches, John Wiley and Sons Inc, 2003
- Ghali, A. and Neville, A.M., Structural Analysis - A Unified Classical and Matrix Approach, E & FN Spon, 2003
- Weaver, W. and Gere, J.M., Matrix Analysis of Framed Structures, CBS Publishers and Distributors, 1996
- Kanchi, M.B., Matrix Methods of Structural Analysis, Wiley Eastern Limited, 1993
- Satyamoorthy, M., Nonlinear Analysis of Structures, CRC Press, 1998
- McGuire, W., Gallagher, R.H. and Ziemian, R.D., Matrix Structural Analysis, 2nd Ed., John Wiley and Sons Publishers, 2000

Prerequisite: NIL

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