CE474 – STRUCTURAL ANALYSIS II [Spring 2007] MWF 1:30-2:20pm, CIVL1252
http://cobweb.ecn.purdue.edu/~ce474

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PREREQUISITES

CE371; good understanding of statics, mechanics of materials, calculus, matrix algebra.
Working level of computer skills (Mathcad, Matlab, or similar) would help. Willingness to learn and study – must.

DESCRIPTION

Basic concepts of structural analysis; virtual work principles; displacement based matrix structural analysis (linear, static): derivation of element stiffness matrices, assembly procedures; special topics in structural analysis; approximate methods of analysis. Emphasis will be on analysis of plane truss and plane frame structures.

OUTLINE

Introduction and Summary of Basic Concepts

- Statical determinacy/indeterminacy
- Kinematic determinacy (degree of freedom)
- Structural idealization

Work-Energy Methods in Structural Analysis

- Conservative systems
- Strain energy (due to axial, bending, shear, torsional forces)
- Using real work to find real deflections
- Principle of virtual forces; using virtual forces to find real deflections (dummy load/unit load method)
- Deflections due to temperature changes, member misfits
- Betti's law & Maxwell's law of reciprocal deflections
- Principle of virtual displacements; using virtual displacements to find real forces
- Use of virtual displacements in plastic analysis

Displacement Method (Stiffness Method)

- Review of matrix algebra
- Stiffness influence coefficients
- Fixed end forces/moments
- Stiffness properties of 1D (bar/rod), 2D (beam) structural elements
- Coordinate transformations
- Formation of the global analysis equations
- General assembly procedure
- Direct stiffness analysis of planar truss systems, frame systems

Special Issues in Stiffness Analysis of Structures

- Thermal and initial strain (temperature change and misfit)
- Displacement boundary conditions
- Shear deformation
- Flexible joints; finite size joints (rigid zones at member ends)

Approximate Methods of Multi-Story Frame Analysis

- Portal method; cantilever method

GRADING
Homework: 15%
2 Term Exams: 25% each
Final Exam: 35%

Average of three exams must be at least 60/100 to receive a passing grade.

Final grades will be based on standard catalogue grade division at the discretion of the instructor:
$A \geq 90$ | $90 > B \geq 80$ | $80 > C \geq 70$ | $70 > D \geq 60$ | $60 > F$

HOMEWORKS
Homeworks will be due at the beginning of class one week from hand-out date; no late homeworks.

Your write-up should be intelligible and of professional quality. Use engineering paper. Do not crowd solutions into a single page (i.e. start each solution on a separate page). Draw your illustrations neatly (use of a straight edge/ruler is encouraged) and mark relevant parameters on your illustrations (labels, degrees of freedom, etc.). State your assumptions where not obvious. Your final answer should be identifiable; no multiple answers.

COLLABORATION POLICY
Homeworks: Solve homework problems on your own. You are NOT allowed to solve together with someone else or let someone solve for you. You may NOT compare the solution steps. You may discuss with your fellow classmates applicable general concepts. Your solution and write-up should be, by definition, yours. Zero-tolerance against transgressions.

Exams: No collaboration or sharing of any kind is allowed. Zero-tolerance against transgressions.

TEXTBOOK (Recommended)
- *Structural Analysis*, R. C. Hibbeler, 6th ed., Pearson/Prentice Hall, 2006.

REFERENCE BOOKS
- *Structural Analysis: A Unified Classical and Matrix Approach* – A. Ghali and A.M. Neville. 2nd ed., Chapman and Hill, 1978 (newer ed. exists)
- *Matrix Structural Analysis* – W. McGuire, R.H. Gallagher, R.D. Ziemian. 2nd ed., J. Wiley and Sons, 2000 (relatively advanced)
- *Theory of Matrix Structural Analysis* – J.S. Przemieniecki. Dover, 1985 (1968 McGraw-Hill ed.)
- *Matrix Structural Analysis* – R.L. Sack. PWS-KENT Publishers, 1989
- *Matrix Structural Analysis* – M.D. Vanderbilt. QPI Press, 1974
- *Intermediate Structural Analysis* – C.K. Wang. International ed., McGraw-Hill, 1983 (other ed.)