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CEE-711/811 = ME-635 = AE-640 = MSIM-795/895 (Fall 2010 Semester)

F I N I T E E L E M E N T A N A L Y S I S 1

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Required Book: An Introduction to the Finite Element Method, THIRD edition, J.N. Reddy, McGraw Hill, 2006

Referenced Book: Finite Element Methods: Parallel-Sparse Statics and Eigen-Solutions, Duc T. Nguyen, Springer Publisher, 2006

Instructor: Professor NGUYEN

Chapter 1: 1.1-1.6 Introduction (including sparse solvers, and imposing boundary conditions)
HWs = see hand-out sheets (based on referenced book)
Chapter 2: 2.1-2.6 Integral Formulations & Variational Methods
HWs = 2.1, 2.2, 2.6, 2.13, (delete 2.16, 2.19)
Chapter 3: 3.1-3.5 Second-Order Differential Equations: FE Models
Hws = 3.1, 3.2, 3.3, 3.7, 3.9, (delete 3.14)
Chapter 4: 4.1-4.7 Second-Order Differential Equations: Applications
Hws = 4.1, (delete 4.3, 4.5, 4.10, 4.42)

Instructor: Professor HAO

Chapter 5: 5.1-5.4 1-D Beam Bending
Chapter 7: 7.1-7.2 Computer Implementation and MATLAB
Chapter 14: 14.5 Finite Element Error Analysis

Instructor: Professor NOOR

Notes are posted on http://www.aee.odu.edu (then CLICK course wiki)

1. Overview of the Numerical Process, Weighted Residual Approaches and Discretization Techniques
2. Detailed Analysis of Individual Finite Elements of various shapes and dimensions
3. The Overall Problem - Detailed Analysis of the Assemblages of Individual Elements of Various shapes and dimensions
4. Guidelines for Finite Element Modeling

Grading Policy:

Class attendance will be credited upto a maximum of 15 points (out of 100).
Every class missed will result in -1 point

Home-works and Projects 30% (Nguyen/Hao/Noor each = 10 %)
Class Attendance ...... 15% (Nguyen/Hao/Noor each = 5 %)
Two exams .... 36% (Nguyen/Hao each = 18 %)
Final exam .... 19% (Noor)

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Note:
Due to the requirement of SACS (for accreditation purpose), students registered at the higher level courses (such as CEE-8xx, or MSIM-8xx etc.) will be required to do ADDITIONAL work (as comparing to those students registered under lower level courses (such as CEE-7xx, or MSIM-7xx, etc.).

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HomeWork Problems (based on Prof. Nguyen's referenced book/class lectures)
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(1) The coefficient (stiffness) matrix for the system of (equilibrium) linear equation is given as:

$$[K] = \begin{bmatrix} 11.0 & 0.0 & 0.0 & 41.0 & 0.0 & 52.0 \\ & 44.0 & 0.0 & 0.0 & 63.0 & 0.0 \\ & & 66.0 & 0.0 & 74.0 & 0.0 \\ & \text{SYM.} & & 88.0 & 85.0 & 0.0 \\ & & & & 110.0 & 97.0 \\ & & & & & 112.0 \end{bmatrix}$$

What is the (computer) memory requirements (in words, using double precision) to store the above matrix data

(a) if the "full matrix storage scheme" is used ??

(b) if the "symmetrical matrix storage scheme" is used ??
(c) if the "symmetrical and banded matrix storage scheme" is used ??
(d) if the "symmetrical and variable banded matrix storage scheme" is used ??
(e) if the "symmetrical and skyline matrix storage scheme" is used ??

(2) Give a precised definition of "column height" of the given matrix ??

(3) For the data given in problem (1), find the column height (NOT including the diagonal terms) ICOLH(-) array ??, what should be the dimension for the integer array ICOLH(-) in this example ??

(4) For the data given in problem (1), find the locations of diagonal terms, array MAXA(-), in this example ??
What should be the dimension for the array MAXA(-) in this example ??

(5) Using the "skyline storage" scheme, and the data given in Problem (1), how can you locate the terms K(4,4)=88.0, and K(2,5)=63.0 in the coresponding 1-dimensional (stiffness) array "skyline storage" scheme ??

(6) Calculate the CHOLESKY factorized term U(3,6), and U(4,6) ??
If you encounter any difficulty here, please explain the reasons ??