F I N I T E E L E M E N T M E T H O D (Fall'2010)

Required Text: "An Introduction to the Finite Element Method", by J.N. Reddy, 3-rd Edition, McGraw-Hill (2006)

Referenced Text: "Finite Element Methods: Parallel-Sparse Statics and Eigen-Solutions", by Duc T. Nguyen, Springer (2006)

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 corresponding 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??