CEE-570   FINITE ELEMENT METHODS
(Same as CSE 551)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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ASSIGNMENT # 6

Given: April 25, 2016. Due: May 2, 2016

Q. 1   This problem was discussed in class. Complete the table on the convergence of Newton Raphson scheme for the following set of parameters till error reduces to a value of 0.036

(a) c=1, k=1.1

(b) c=0.5, k=1

NOTE: For k=2, it took 5 iterations to reduce the error to 0.036

Q. 2   This problem was discussed in class. Continue the class lecture on nonlinear bar-structure and complete the N-R convergence for the second load step by showing your hand calculations. Specifically, the first two iterations for step-2 were completed in class. Show all the detailed steps for iteration number 3 and number 4, and thereon make a table and list the important values for the remaining iterations till convergence is achieved.

Q. 3   Consider the simple bar structure that was discussed in the class. Following along the lines of the solution procedure discussed in the class, write a computer program to solve the problem. Use tolerance parameter $\varepsilon = 10^{-12}$. Apply the total load in 2 steps and obtain the force-displacement curve by:

  I.   Newton-Raphson method.

  II.   Modified Newton method.

- Write in detail the algorithm and the solution procedure.
- Draw a comprehensive flow chart.
- Attach the listing of computed results, indicating the number of iterations required for each load step and the residual reduction in each iteration.
- Plot the force-displacement curve obtained from the program.
- Write your comments about the algorithm in light of the performance of Newton-Raphson method versus Modified Newton method that you have implemented.

- Also, email your source code to TA Soonpil Kang at skang67@illinois.edu

NOTE: You can use your hand calculations from Q2 to debug your code in Q3.