2.092/2.093

FINITE ELEMENT ANALYSIS OF SOLIDS AND FLUIDS I

FALL 2009

Homework 8

Instructor:	Prof. K. J. Bathe	Assigned: Session 23
TA:	Seounghyun Ham	Due: Session 25

Problem 1 (20 points):

Consider Problem 1 of Homework 7.

a) Calculate the static correction to the analysis performed in Homework 7.

b) Compare by plots the solutions obtained with (i) using one mode plus the static correction and (ii) using two modes, and discuss your results.

Problem 2 (10 points):

Establish a Rayleigh damping matrix C for the system of Problem 1 of Homework 7, which gives modal damping parameters, ξ_1=0.02 and ξ_2=0.10.

Problem 3 (20 points):

Consider the generalized eigenvalue problem

$$\begin{bmatrix} 4 & -1 & 0 \\ -1 & 3 & -1 \\ 0 & -1 & 4 \end{bmatrix} \underline{\phi} = \lambda \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix} \underline{\phi}$$

a) Calculate the eigenvalues and eigenvectors and show explicitly that these vectors are M- and K- orthogonal.

b) Find (any) two vectors that are M- and K- orthogonal but are not eigenvectors.

Problem 4 (20 points):

Consider the system in Problem 3.

Perform two subspace iterations with the starting vectors

$$\underline{X}_1 = \begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 1 & -1 \end{bmatrix}$$

That is, calculate $\underline{X}_2$ and $\underline{X}_3$, and hence the approximations to the exact eigenvalues and eigenvectors (obtained in Problem 3).

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