2.092/2.093

FINITE ELEMENT ANALYSIS OF SOLIDS AND FLUIDS I

FALL 2009

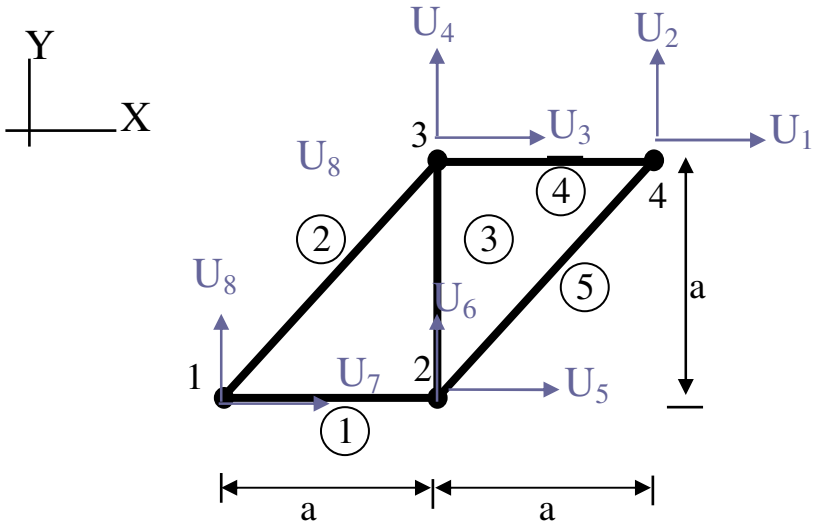
Homework 1

Instructor:	Prof. K. J. Bathe	Assigned: Session 3
TA:	Seounghyun Ham	Due: Session 5

Problem 1 (30 points):

Consider the truss problem already discussed in class, in linear elastic analysis, but with all displacement boundary conditions removed and no applied load.

$A\left[m^2\right]$ = cross-sectional area of each bar, $E\left[N/m^2\right]$, and $a[m]$.



a) Develop by the physical reasoning used in class that is "by inspection" the **K** matrix for

$$\underline{\mathbf{K}}\begin{bmatrix} U_1 \\ \vdots \\ U_8 \end{bmatrix} = \begin{bmatrix} R_1 \\ \vdots \\ R_8 \end{bmatrix}$$

b) Now assume $U_1 = U_2 = U_4 = U_7 = U_8 = 0$ and the external loads, $R_3 = 0$, $R_5 = 60kN$, and $R_6 = 0$. Calculate the displacements, U_3, U_5, and U_6 and sketch the deflected shape of the structure.

c) Calculate all internal element forces and the reactions corresponding to U_1, U_2, U_4, U_7 and U_8.

d) Show explicitly that element 3 and joint (node) 3 are in equilibrium. Show that the complete structure is in equilibrium.

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