

CE 3310: Advanced Structural Analysis

Tutorial - 4 : Axial Elements (Matrix Methods)

Take $EA = 100 \times$ last two digits of your Roll No (kN).

1. Analyse the non-prismatic axially loaded structural system, ABCD, shown in Fig. 1, with an elastic support at D, by the conventional Stiffness Method. Generate the structure stiffness matrix and equivalent joint loads using both,
 - i. Transformation matrix T^i
 - ii. Displacement transformation matrix T_D

Find the deflections at A, B and D (D_1 , D_2 and D_3 respectively) and support reaction at E. Draw the axial force distribution.

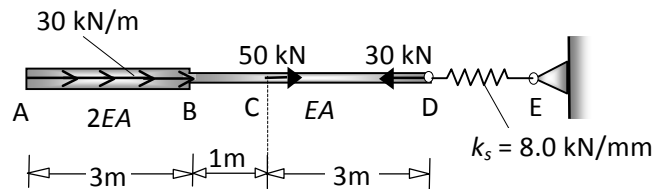


Fig. 1

2. Using the Reduced Element Stiffness method, assemble the 2×2 stiffness matrix for the plane truss in Fig. 2, assuming all bars to have equal axial rigidity EA . If the bars are force-fitted due to bar '2' being short by 5mm (fabrication error), find the joint displacements $\{D_A\}$ and the bar forces $\{N\}$. Also include the effect of the applied loads $F_1=50$ kN and $F_2=-25$ kN.

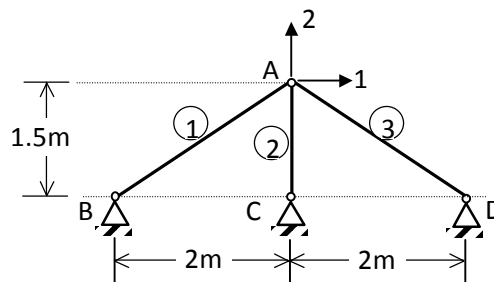


Fig. 2

3. Repeat Problem 2 by the Flexibility Method, considering the force in bar '3' as the redundant. Find the axial forces in the three bars and deflections of joint A.