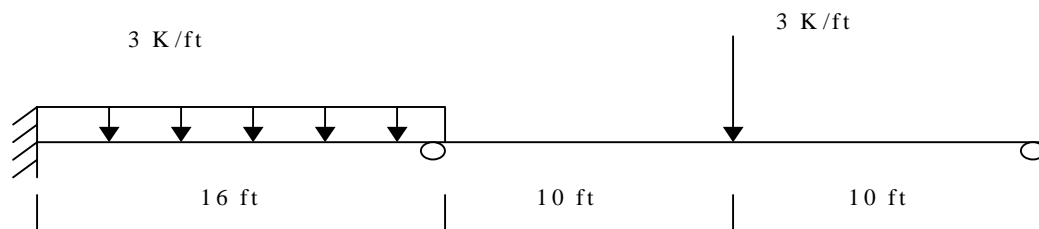
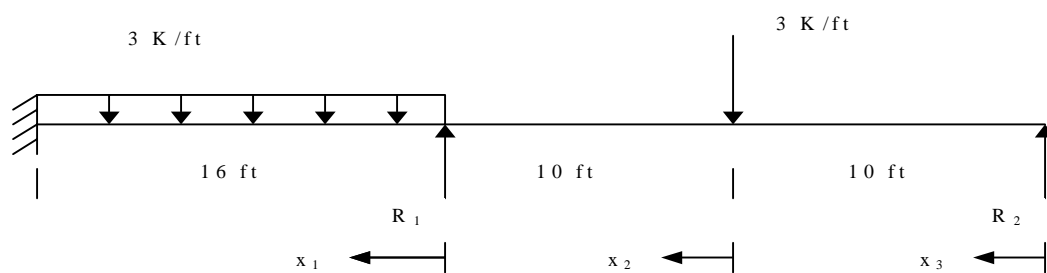


Homework #2 CES 6106 Fall 2000

Given the structure below, use consistent deformations to find the reactions.



The determinate base structure (Case 0) is:



The moment equations for case 0 are:

$$M_1 := 12 \cdot (10 + x_1) + \frac{2 \cdot x_1^2}{2}$$

$$M_2 := -12 \cdot x_2$$

$$M_3 := 0$$

The unit load at redundant 1 is:

The moment equations for case 1 are:

$$M1_1 := -x_1$$

$$M1_2 := 0$$

$$M1_3 := 0$$

The moment equations for case 2 are:

$$M2_1 := -(x_1 + 20)$$

$$M2_2 := -(x_2 + 10)$$

$$M2_3 := -x_3$$

Calculation for the required displacement are:

$$\Delta_{10} := \frac{1}{EI} \left(\int_0^{16} M1_1 \cdot M1_1 dx_1 \right) \rightarrow \frac{-48128}{EI}$$

$$\Delta_{20} := \left(\int_0^{16} M1_1 \cdot M2_1 dx_1 \right) \frac{1}{EI} + \left(\int_0^{10} M2_2 \cdot M2_2 dx_2 \right) \frac{1}{EI} \rightarrow \frac{-403664}{(3 \cdot EI)}$$

$$f_{11} := \frac{1}{EI} \left(\int_0^{16} M1_1 \cdot M1_1 dx_1 \right) \rightarrow \frac{4096}{(3 \cdot EI)}$$

$$f_{22} := \left(\int_0^{36} M2_3 \cdot M2_3 dx_3 \right) \frac{1}{EI} \rightarrow \frac{15552}{EI}$$

$$f_{12} := \frac{1}{EI} \left(\int_0^{16} M1_1 \cdot M2_1 dx_1 \right) \rightarrow \frac{11776}{(3 \cdot EI)}$$

Fill matrix with terms:

$$F := \begin{pmatrix} f_{11} & f_{12} \\ f_{12} & f_{22} \end{pmatrix} \rightarrow \begin{bmatrix} \frac{4096}{(3 \cdot EI)} & \frac{11776}{(3 \cdot EI)} \\ \frac{11776}{(3 \cdot EI)} & \frac{15552}{EI} \end{bmatrix}$$

$$F := \begin{bmatrix} \frac{f_{22}}{(f_{11} \cdot f_{22} - f_{12}^2)} & \frac{-f_{12}}{(f_{11} \cdot f_{22} - f_{12}^2)} \\ \frac{-f_{12}}{(f_{11} \cdot f_{22} - f_{12}^2)} & \frac{f_{11}}{(f_{11} \cdot f_{22} - f_{12}^2)} \end{bmatrix} \rightarrow \begin{pmatrix} \frac{2187}{819200} \cdot EI & \frac{-69}{102400} \cdot EI \\ \frac{-69}{102400} \cdot EI & \frac{3}{12800} \cdot EI \end{pmatrix}$$

$$P := \begin{pmatrix} \Delta_{10} \\ \Delta_{20} \end{pmatrix} \rightarrow \begin{bmatrix} \frac{-48128}{EI} \\ \frac{-403664}{(3 \cdot EI)} \end{bmatrix}$$

$$X := F \cdot P \rightarrow \begin{pmatrix} \frac{-48409}{1280} \\ \frac{143}{160} \end{pmatrix}$$