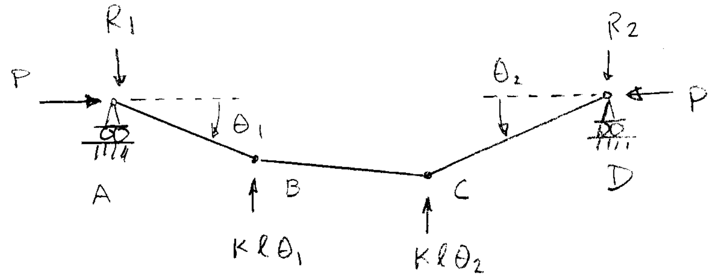


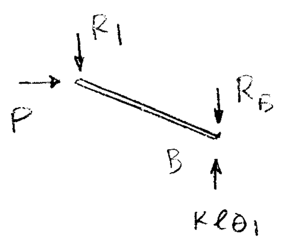
(a)

$$\sum M_A = (Kl\theta_1)l + Kl\theta_2\,(2l) = R_2\,(3l)$$

$$\therefore \quad R_2 = \frac{kl}{3}\,(\theta_1 + 2\theta_2)$$

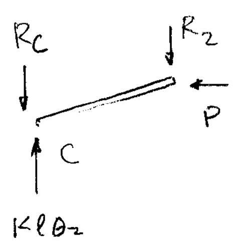
$$\sum F = R_1 + R_2 - Kl\theta_1 - Kl\theta_2 = 0$$

$$\therefore \quad R_1 = Kl\theta_1 + Kl\theta_2 - R_2 = \frac{Kl}{3}\,(2\theta_1 + \theta_2)$$



$$\sum M_B = R_1 \cdot l - Pl\theta_1 = 0$$

$$\therefore \quad \frac{kl}{3}\,(2\theta_1 + \theta_2) = P\theta_1 \quad \text{------} \quad (1)$$



$$\sum M_C = R_2 \cdot l - P \cdot l\,\theta_2 = 0$$

$$\frac{kl}{3}\,(\theta_1 + 2\theta_2) = P\theta_2 \quad \text{------} \quad (2)$$

Combine (1) & (2)

$$\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} \theta_1 \\ \theta_2 \end{bmatrix} = \frac{3P}{kl} \begin{bmatrix} \theta_1 \\ \theta_2 \end{bmatrix}$$

(b) The buckling Load must be real.

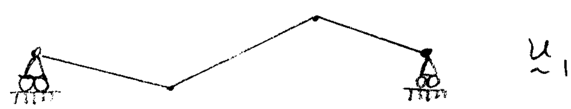
(c) $$|\underset{\sim}{A} - \lambda \underset{\sim}{I}| = \begin{vmatrix} 2-\lambda & 1 \\ 1 & 2-\lambda \end{vmatrix} = (\lambda-2)^2 - 1 = (\lambda-1)(\lambda-3) = 0$$

$$\lambda_1 = 1, \ \lambda_2 = 3$$

For $\lambda_1 = \frac{3P_1}{k\ell} = 1 \Rightarrow P_1 = \frac{k\ell}{3}$

$$[\underset{\sim}{A} - \lambda_1 \underset{\sim}{I}]\underset{\sim}{u}_1 = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \underset{\sim}{u}_1 = 0 \Rightarrow \underset{\sim}{u}_1 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

buckling shape



For $\lambda_2 = \frac{3P_2}{k\ell} = 3, \quad P_2 = k\ell$

$$[\underset{\sim}{A} - \lambda_2 \underset{\sim}{I}]\underset{\sim}{u}_2 = \begin{bmatrix} -1 & 1 \\ 1 & -1 \end{bmatrix} \underset{\sim}{u}_2 = \underset{\sim}{0}. \quad \underset{\sim}{u}_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

Buckling Shape