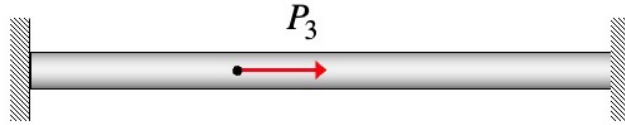
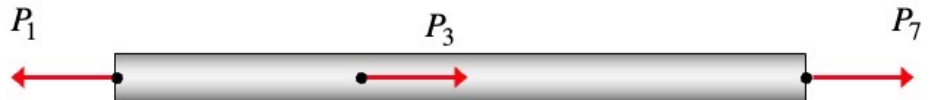


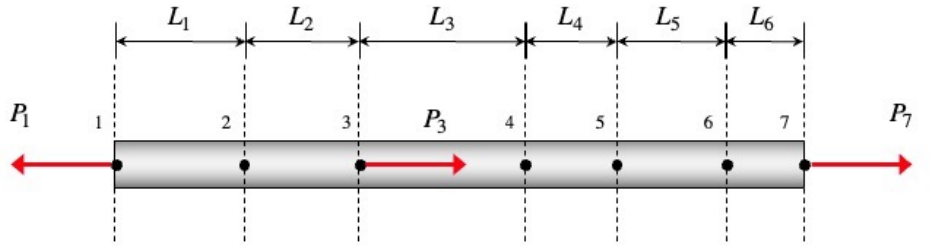
Building the finite element equations for a rod



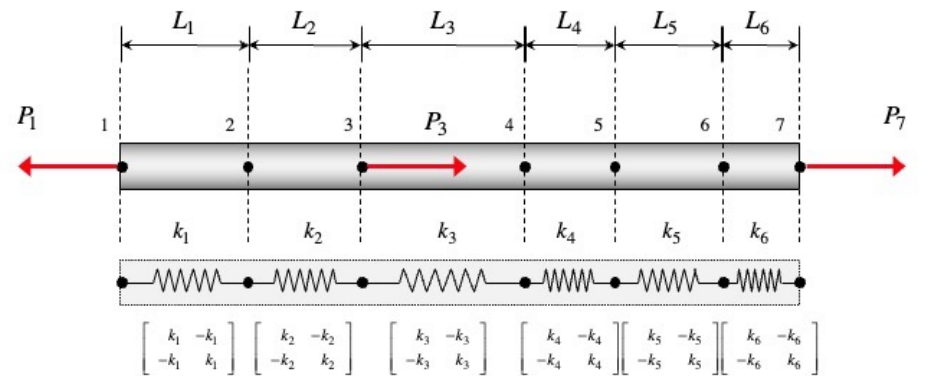
Draw FBD of rod



Define N+1 nodes
and N elements



Determine elemental
stiffnesses and
elemental stiffness
matrices



Determine global
stiffness matrix and
forcing vector

$$[K] = \begin{bmatrix} k_1 & -k_1 & 0 & 0 & 0 & 0 & 0 \\ -k_1 & k_2 & -k_2 & 0 & 0 & 0 & 0 \\ 0 & -k_2 & k_2+k_3 & -k_3 & 0 & 0 & 0 \\ 0 & 0 & -k_3 & k_3+k_4 & -k_4 & 0 & 0 \\ 0 & 0 & 0 & -k_4 & k_4+k_5 & -k_5 & 0 \\ 0 & 0 & 0 & 0 & -k_5 & k_5+k_6 & -k_6 \\ 0 & 0 & 0 & 0 & 0 & -k_6 & k_6 \end{bmatrix} \quad \{F\} = \begin{bmatrix} -P_1 \\ 0 \\ P_3 \\ 0 \\ 0 \\ 0 \\ P_7 \end{bmatrix}$$

Enforce BCs

$$[K] = \begin{bmatrix} k_1 & -k_1 & 0 & 0 & 0 & 0 & 0 \\ -k_1 & k_2 & -k_2 & 0 & 0 & 0 & 0 \\ 0 & -k_2 & k_2+k_3 & -k_3 & 0 & 0 & 0 \\ 0 & 0 & -k_3 & k_3+k_4 & -k_4 & 0 & 0 \\ 0 & 0 & 0 & -k_4 & k_4+k_5 & -k_5 & 0 \\ 0 & 0 & 0 & 0 & -k_5 & k_5+k_6 & -k_6 \\ 0 & 0 & 0 & 0 & 0 & -k_6 & k_6 \end{bmatrix} \quad \{F\} = \begin{bmatrix} -P_1 \\ 0 \\ P_3 \\ 0 \\ 0 \\ 0 \\ -P_7 \end{bmatrix}$$

Solve for
displacements

$$\{u\} = [K]^{-1} \{F\}$$