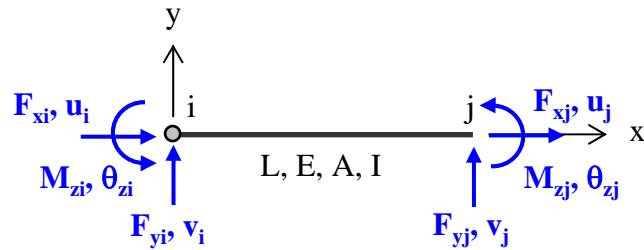
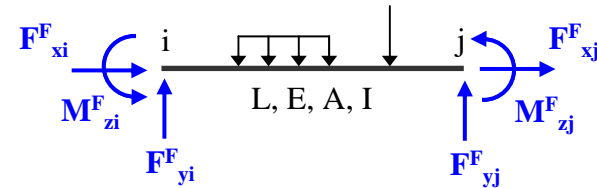


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Moment release at the left end (node i) of the member



Member end forces and displacements



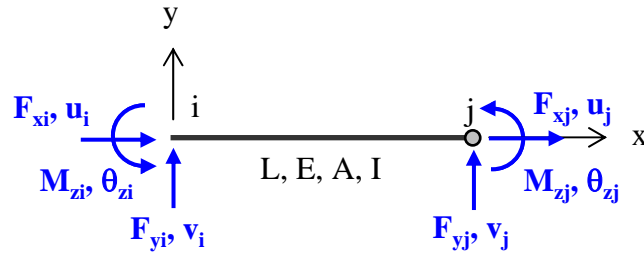
Member fixed-end forces and moments

$$\begin{Bmatrix} F_{xi} \\ F_{yi} \\ M_{zi} \\ F_{xj} \\ F_{yj} \\ M_{zj} \end{Bmatrix} = \begin{bmatrix} \frac{EA}{L} & 0 & 0 & -\frac{EA}{L} & 0 & 0 \\ 0 & \frac{3EI}{L^3} & 0 & 0 & -\frac{3EI}{L^3} & \frac{3EI}{L^2} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{EA}{L} & 0 & 0 & \frac{EA}{L} & 0 & 0 \\ 0 & -\frac{3EI}{L^3} & 0 & 0 & \frac{3EI}{L^3} & -\frac{3EI}{L^2} \\ 0 & \frac{3EI}{L^2} & 0 & 0 & -\frac{3EI}{L^2} & \frac{3EI}{L} \end{bmatrix} \begin{Bmatrix} u_i \\ v_i \\ \theta_{zi} \\ u_j \\ v_j \\ \theta_{zj} \end{Bmatrix} + \begin{Bmatrix} F_{xi}^F \\ F_{yi}^F - \frac{3}{2L} M_{zi}^F \\ 0 \\ F_{xj}^F \\ F_{yj}^F + \frac{3}{2L} M_{zi}^F \\ M_{zj}^F - \frac{1}{2} M_{zi}^F \end{Bmatrix}$$

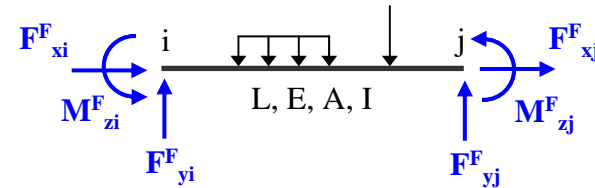
Member force-displacement relationship in local coordinates

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Moment release at the right end (node j) of the member



Member end forces and displacements



Member fixed-end forces and moments

$$\begin{Bmatrix} F_{xi} \\ F_{yi} \\ M_{zi} \\ F_{xj} \\ F_{yj} \\ M_{zj} \end{Bmatrix} = \begin{bmatrix} \frac{EA}{L} & 0 & 0 & -\frac{EA}{L} & 0 & 0 \\ 0 & \frac{3EI}{L^3} & \frac{3EI}{L^2} & 0 & -\frac{3EI}{L^3} & 0 \\ 0 & \frac{3EI}{L^2} & \frac{3EI}{L} & 0 & -\frac{3EI}{L^2} & 0 \\ -\frac{EA}{L} & 0 & 0 & \frac{EA}{L} & 0 & 0 \\ 0 & -\frac{3EI}{L^3} & -\frac{3EI}{L^2} & 0 & \frac{3EI}{L^3} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{Bmatrix} u_i \\ v_i \\ \theta_{zi} \\ u_j \\ v_j \\ \theta_{zj} \end{Bmatrix} + \begin{Bmatrix} F_{xi}^F \\ F_{yi}^F - \frac{3}{2L}M_{zj}^F \\ M_{zi}^F - \frac{1}{2}M_{zj}^F \\ F_{xj}^F \\ F_{yj}^F + \frac{3}{2L}M_{zj}^F \\ 0 \end{Bmatrix}$$

Member force-displacement relationship in local coordinates