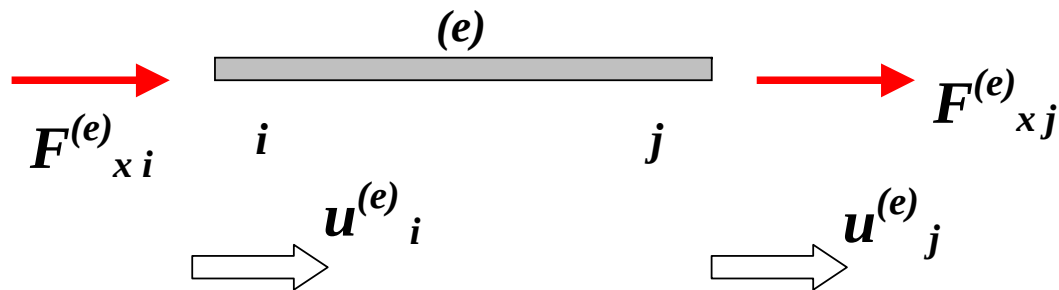
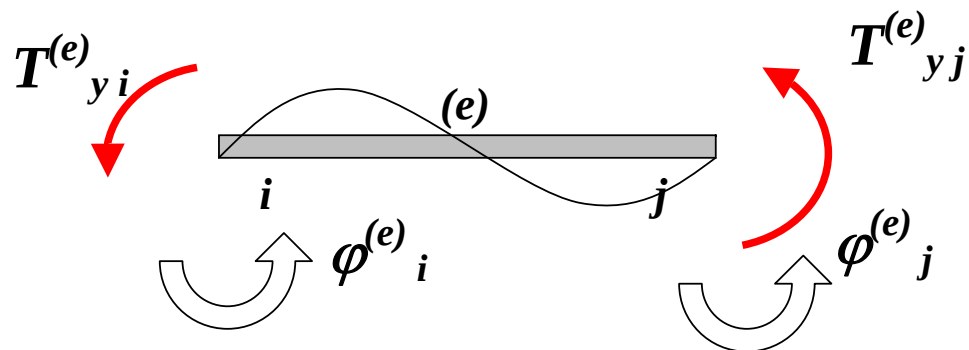


extensie



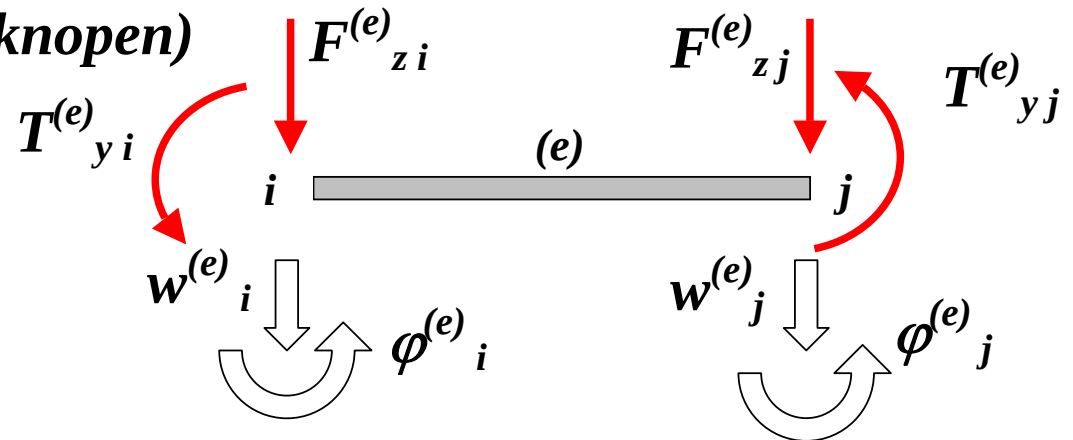
$$\begin{Bmatrix} F_{xi}^{(e)} \\ F_{xj}^{(e)} \end{Bmatrix} = \frac{EA}{l} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{Bmatrix} u_i^{(e)} \\ u_j^{(e)} \end{Bmatrix}$$

buiging (niet-verplaatsbare knopen)



$$\begin{Bmatrix} T_{yi}^{(e)} \\ T_{yj}^{(e)} \end{Bmatrix} = \frac{EI}{l} \begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix} \begin{Bmatrix} \varphi_i^{(e)} \\ \varphi_j^{(e)} \end{Bmatrix}$$

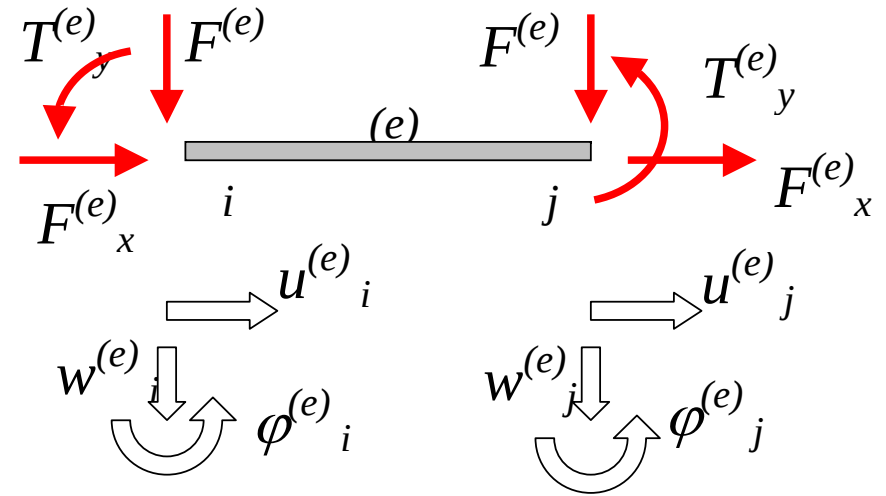
buiging (met verplaatsbare knopen)



$$\begin{Bmatrix} F_{zi}^{(e)} \\ T_{yi}^{(e)} \\ F_{zj}^{(e)} \\ T_{yj}^{(e)} \end{Bmatrix} = \begin{bmatrix} \frac{12EI}{l^3} & \frac{-6EI}{l^2} & \frac{-12EI}{l^3} & \frac{-6EI}{l^2} \\ \frac{-6EI}{l^2} & \frac{4EI}{l} & \frac{6EI}{l^2} & \frac{2EI}{l} \\ \frac{-12EI}{l^3} & \frac{6EI}{l^2} & \frac{12EI}{l^3} & \frac{6EI}{l^2} \\ \frac{-6EI}{l^2} & \frac{2EI}{l} & \frac{6EI}{l^2} & \frac{4EI}{l} \end{bmatrix} \begin{Bmatrix} w_i^{(e)} \\ \phi_i^{(e)} \\ w_j^{(e)} \\ \phi_j^{(e)} \end{Bmatrix}$$

ALGEMENE STAAF

(extensie +
buiging met verplaatsbare knopen)



$$\begin{Bmatrix} F_{x_i} \\ F_{z_i} \\ T_{y_i} \\ F_{x_j} \\ F_{z_j} \\ T_{y_j} \end{Bmatrix}^{(e)} = \begin{bmatrix} \boxed{\frac{EA}{l}} & 0 & 0 & \boxed{-\frac{EA}{l}} & 0 & 0 \\ 0 & \frac{12EI}{l^3} & -\frac{6EI}{l^2} & 0 & -\frac{12EI}{l^3} & -\frac{6EI}{l^2} \\ 0 & -\frac{6EI}{l^2} & \boxed{\frac{4EI}{l}} & 0 & \frac{6EI}{l^2} & \boxed{\frac{2EI}{l}} \\ \boxed{-\frac{EA}{l}} & 0 & 0 & \boxed{\frac{EA}{l}} & 0 & 0 \\ 0 & -\frac{12EI}{l^3} & \frac{6EI}{l^2} & 0 & \frac{12EI}{l^3} & \frac{6EI}{l^2} \\ 0 & -\frac{6EI}{l^2} & \boxed{\frac{2EI}{l}} & 0 & \frac{6EI}{l^2} & \boxed{\frac{4EI}{l}} \end{bmatrix}^{(e)} \begin{Bmatrix} u_i \\ w_i \\ \phi_i \\ u_j \\ w_j \\ \phi_j \end{Bmatrix}^{(e)}$$