

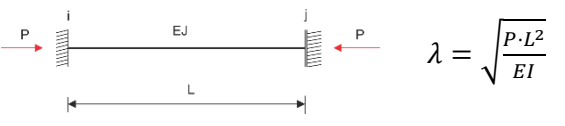
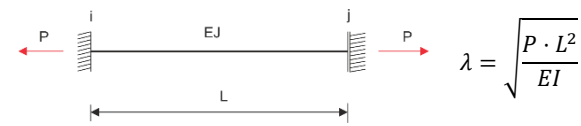
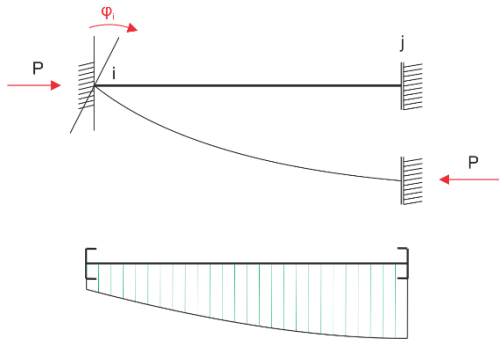
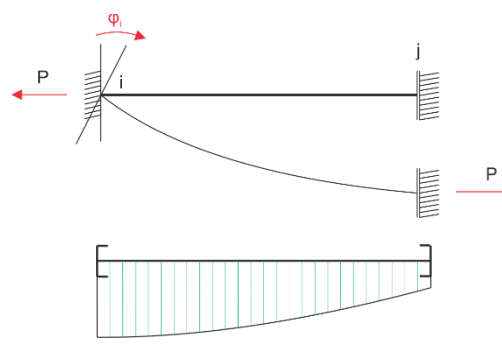
Typ I - pręt obustronnie zamocowany

ŚCISKANIE	
$\lambda = \sqrt{\frac{P \cdot L}{EJ}}$	
Obrót węzła $Q_i = \frac{\gamma(\lambda)EI}{L^2} \varphi_i$ $M_j = \frac{\beta(\lambda)EI}{L} \varphi_i$ $M_i = \frac{\alpha(\lambda)EI}{L} \varphi_i$ $Q_j = \frac{\gamma(\lambda)EI}{L^2} \varphi_i$	Wzajemne przemieszczenie węzłów $\psi = \frac{\Delta_{ij}}{L}$ $M_i = \frac{\gamma(\lambda)EI}{L} \psi$ $Q_j = \frac{\delta(\lambda)EI}{L^2} \psi$ $Q_i = \frac{\delta(\lambda)EI}{L^2} \psi$ $M_j = \frac{\gamma(\lambda)EI}{L} \psi$
Funkcja $\alpha(\lambda)$ $\alpha(\lambda) := \lambda \cdot \frac{\sin(\lambda) - \lambda \cdot \cos(\lambda)}{2 \cdot (1 - \cos(\lambda)) - \lambda \cdot \sin(\lambda)}$	Funkcja $\beta(\lambda)$ $\beta(\lambda) := \lambda \cdot \frac{\lambda - \sin(\lambda)}{2 \cdot (1 - \cos(\lambda)) - \lambda \cdot \sin(\lambda)}$
Funkcja $\gamma(\lambda)$ $\gamma(\lambda) := \lambda^2 \cdot \frac{1 - \cos(\lambda)}{2 \cdot (1 - \cos(\lambda)) - \lambda \cdot \sin(\lambda)}$	Funkcja $\delta(\lambda)$ $\delta(\lambda) := \lambda^3 \cdot \frac{\sin(\lambda)}{2 \cdot (1 - \cos(\lambda)) - \lambda \cdot \sin(\lambda)}$
ROZCIĄGANIE	
$\lambda = \sqrt{\frac{P \cdot L}{EI}}$	
Obrót węzła $Q_i = \frac{\gamma_r(\lambda)EI}{L^2} \varphi_i$ $M_j = \frac{\beta_r(\lambda)EI}{L} \varphi_i$ $M_i = \frac{\alpha_r(\lambda)EI}{L} \varphi_i$ $Q_j = \frac{\gamma(\lambda)EI}{L^2} \varphi_i$	Wzajemne przemieszczenie węzłów $\psi = \frac{\Delta_{ij}}{L}$ $M_i = \frac{\gamma(\lambda)EI}{L} \psi$ $Q_j = \frac{\delta_r(\lambda)EI}{L^2} \psi$ $Q_i = \frac{\delta_r(\lambda)EI}{L^2} \psi$ $M_j = \frac{\gamma(\lambda)EI}{L} \psi$
Funkcja $\alpha_r(\lambda)$ $\alpha_r(\lambda) := \lambda \cdot \frac{1 - \cosh(\lambda)}{2 \cdot (-1 + \cosh(\lambda)) - \lambda \cdot \sinh(\lambda)}$	Funkcja $\beta_r(\lambda)$ $\beta_r(\lambda) := \lambda \cdot \frac{\lambda - \sinh(\lambda)}{2 \cdot (-1 + \cosh(\lambda)) - \lambda \cdot \sinh(\lambda)}$
Funkcja $\gamma_r(\lambda)$ $\gamma_r(\lambda) := \lambda^2 \cdot \frac{1 - \cosh(\lambda)}{2 \cdot (-1 + \cosh(\lambda)) - \lambda \cdot \sinh(\lambda)}$	Funkcja $\delta_r(\lambda)$ $\delta_r(\lambda) := \lambda^3 \cdot \frac{-\sinh(\lambda)}{2 \cdot (-1 + \cosh(\lambda)) - \lambda \cdot \sinh(\lambda)}$

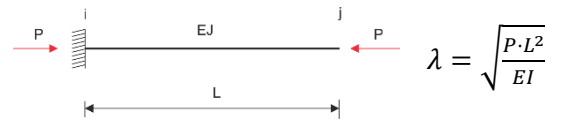

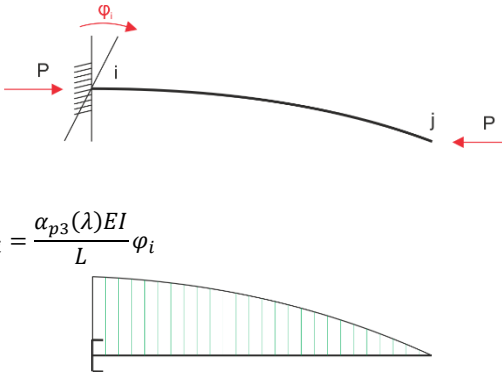
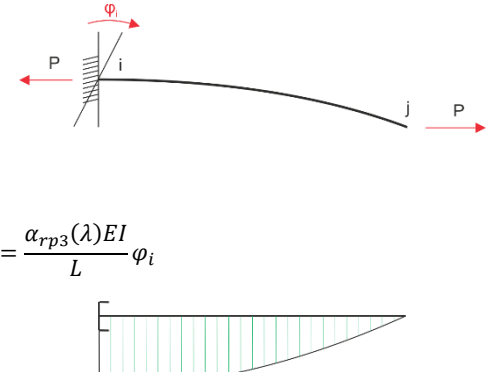
Typ II - pręt jednostronnie zamocowany

<u>ŚCISKANIE</u>	
$\lambda = \sqrt{\frac{P \cdot L^2}{EI}}$	
<p style="text-align: center;">Obrót węzła</p> $Q_i = \frac{\alpha_p(\lambda)EI}{L^2} \varphi_i$ $Q_j = \frac{\alpha_p(\lambda)EI}{L^2} \varphi_i$ $M_i = \frac{\alpha_p(\lambda)EI}{L} \varphi_i$	<p style="text-align: center;">Wzajemne przemieszczenie węzłów</p> $\psi = \frac{\Delta_{ij}}{L}$ $M_i = \frac{\alpha_p(\lambda)EI}{L} \psi$ $Q_i = \frac{\delta_p(\lambda)EI}{L^2} \psi$ $Q_j = \frac{\delta_p(\lambda)EI}{L^2} \psi$
<p>Funkcja $\alpha_p(\lambda)$</p> $\alpha_p(\lambda) := \lambda^2 \cdot \frac{\sin(\lambda)}{\sin(\lambda) - \lambda \cdot \cos(\lambda)}$	<p>Funkcja $\delta_p(\lambda)$</p> $\delta_p(\lambda) := \lambda^3 \cdot \frac{\cos(\lambda)}{\sin(\lambda) - \lambda \cdot \cos(\lambda)}$
<u>ROZCIĄGANIE</u>	
$\lambda = \sqrt{\frac{P \cdot L^2}{EI}}$	
<p style="text-align: center;">Obrót węzła</p> $Q_i = \frac{\alpha_{rp}(\lambda)EI}{L^2} \varphi_i$ $Q_j = \frac{\alpha_{rp}(\lambda)EI}{L^2} \varphi_i$ $M_i = \frac{\alpha_{rp}(\lambda)EI}{L} \varphi_i$	<p style="text-align: center;">Wzajemne przemieszczenie węzłów</p> $\psi = \frac{\Delta_{ij}}{L}$ $M_i = \frac{\alpha_{rp}(\lambda)EI}{L} \psi$ $Q_i = \frac{\delta_{rp}(\lambda)EI}{L^2} \psi$ $Q_j = \frac{\delta_{rp}(\lambda)EI}{L^2} \psi$
<p>Funkcja $\alpha_{rp}(\lambda)$</p> $\alpha_{rp}(\lambda) := \lambda^2 \cdot \frac{\sinh(\lambda)}{-\sinh(\lambda) + \lambda \cdot \cosh(\lambda)}$	<p>Funkcja $\delta_{rp}(\lambda)$</p> $\delta_{rp}(\lambda) := \lambda^3 \cdot \frac{\cosh(\lambda)}{-\sinh(\lambda) + \lambda \cdot \cosh(\lambda)}$

Typ III – pręt zamocowany z jednostronną możliwością przesuwu

<p style="text-align: center;"><u>ŚCISKANIE</u></p> 	<p style="text-align: center;"><u>ROZCIĄGANIE</u></p> 
<p style="text-align: center;">Obrót węzła</p>  <p style="text-align: center;">$M_i = \frac{\alpha_{p2}(\lambda)EI}{L} \varphi_i$ $M_j = \frac{\beta_{p2}(\lambda)EI}{L} \varphi_i$</p>	<p style="text-align: center;">Obrót węzła</p>  <p style="text-align: center;">$M_i = \frac{\alpha_{rp2}(\lambda)EI}{L} \varphi_i$ $M_j = \frac{\beta_{rp2}(\lambda)EI}{L} \varphi_i$</p>
<p style="text-align: center;">Funkcja $\alpha_{p2}(\lambda)$ $\alpha_{p2}(\lambda) := \lambda \cdot \text{ctg}(\lambda)$</p>	<p style="text-align: center;">Funkcja $\alpha_{rp2}(\lambda)$ $\alpha_{rp2}(\lambda) := \lambda \cdot \text{ctg} h(\lambda)$</p>
<p style="text-align: center;">Funkcja $\beta_{p2}(\lambda)$ $\beta_{p2}(\lambda) := \frac{\lambda}{\sin(\lambda)}$</p>	<p style="text-align: center;">Funkcja $\beta_{rp2}(\lambda)$ $\beta_{rp2}(\lambda) := \frac{\lambda}{\sin h(\lambda)}$</p>

Typ wspornik – pręt wspornikowy

<p style="text-align: center;"><u>ŚCISKANIE</u></p> 	<p style="text-align: center;"><u>ROZCIĄGANIE</u></p> 
<p style="text-align: center;">Obrót węzła</p>  <p style="text-align: center;">$M_i = \frac{\alpha_{p3}(\lambda)EI}{L} \varphi_i$</p>	<p style="text-align: center;">Obrót węzła</p>  <p style="text-align: center;">$M_i = \frac{\alpha_{rp3}(\lambda)EI}{L} \varphi_i$</p>
<p style="text-align: center;">Funkcja $\alpha_{p3}(\lambda)$ $\alpha_{p3}(\lambda) := \lambda \cdot \text{tg}(\lambda)$</p>	<p style="text-align: center;">Funkcja $\alpha_{rp3}(\lambda)$ $\alpha_{rp3}(\lambda) := \lambda \cdot \text{tg} h(\lambda)$</p>