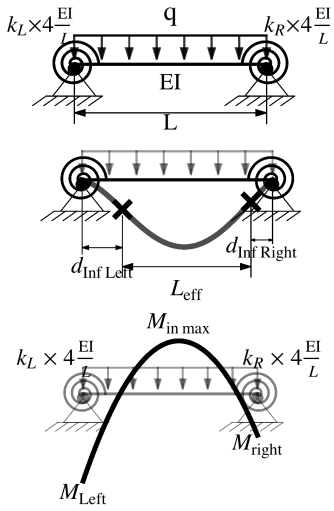
$$K^{\text{truss member}} = \frac{EA}{L}\begin{pmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{pmatrix} \qquad K^{\text{beam member}} = \begin{pmatrix} \frac{c^2EA}{L}+\frac{12EIs^2}{L^3} & -\frac{12csEI}{L^3}+\frac{csEA}{L} & \frac{6EIs}{L^2} & -\frac{c^2EA}{L}-\frac{12EIs^2}{L^3} & \frac{12csEI}{L^3}-\frac{csEA}{L} & \frac{6EIs}{L^2} \\ -\frac{12csEI}{L^3}+\frac{csEA}{L} & \frac{12c^2EI}{L^3}+\frac{EAs^2}{L} & -\frac{6cEI}{L^2} & \frac{12csEI}{L^3}-\frac{csEA}{L} & -\frac{12c^2EI}{L^3}-\frac{EAs^2}{L} & -\frac{6cEI}{L^2} \\ \frac{6EIs}{L^2} & -\frac{6cEI}{L^2} & \frac{4EI}{L} & -\frac{6EIs}{L^2} & \frac{6cEI}{L^2} & \frac{2EI}{L} \\ -\frac{c^2EA}{L}-\frac{12EIs^2}{L^3} & \frac{12csEI}{L^3}-\frac{csEA}{L} & -\frac{6EIs}{L^2} & \frac{c^2EA}{L}+\frac{12EIs^2}{L^3} & -\frac{12csEI}{L^3}+\frac{csEA}{L} & -\frac{6EIs}{L^2} \\ \frac{12csEI}{L^3}-\frac{csEA}{L} & -\frac{12c^2EI}{L^3}-\frac{EAs^2}{L} & \frac{6cEI}{L^2} & -\frac{12csEI}{L^3}+\frac{csEA}{L} & \frac{12c^2EI}{L^3}+\frac{EAs^2}{L} & \frac{6cEI}{L^2} \\ \frac{6EIs}{L^2} & -\frac{6cEI}{L^2} & \frac{2EI}{L} & -\frac{6EIs}{L^2} & \frac{6cEI}{L^2} & \frac{4EI}{L} \end{pmatrix}$$



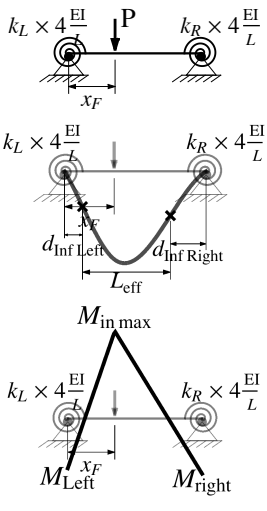
$$\frac{d_{\text{inf left}}}{L} \approx \frac{0.92\,k_L}{3+4\,k_L}$$

$$\frac{d_{\text{inf right}}}{L} \approx \frac{0.92\,k_R}{3+4\,k_R}$$

$$M_{\text{in max}} = \frac{qL_{\text{eff}}^2}{8}$$

$$M_{\text{left}} = \frac{qd_{\text{IL}}\,(L_{\text{eff}}+d_{\text{IL}})}{2}$$

$$M_{\text{right}} = \frac{qd_{\text{IR}}\,(L_{\text{eff}}+d_{\text{IR}})}{2}$$



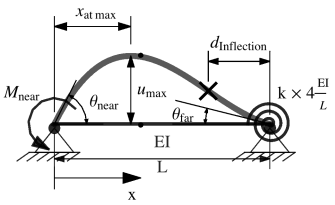
$$\frac{d_{\text{inf left}}}{L} \approx \frac{3\,k_L}{2+4\,k_L}\,\frac{x_f/L}{1+x_f/L}$$

$$\frac{d_{\text{inf right}}}{L} \approx \frac{3\,k_R}{2+4\,k_R}\,\frac{1-x_f/L}{1+(1-x_f/L)}$$

$$M_{\text{in max}} = \frac{P(x_f-d_{\text{IL}})(L-x_f-d_{\text{IR}})}{L_{\text{eff}}}$$

$$M_{\text{left}} = \frac{P\,d_{\text{IL}}\,(L-x_f-d_{\text{IR}})}{L_{\text{eff}}}$$

$$M_{\text{right}} = \frac{P\,d_{\text{IR}}\,(x_f-d_{\text{IL}})}{L_{\text{eff}}}$$



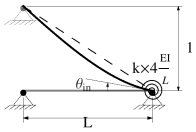
$$\frac{M_{\text{far}}}{M_{\text{near}}} = \frac{2k}{3+4k}$$

$$\frac{d_{\text{inflection}}}{L} = \frac{2\,k}{3+6\,k}$$

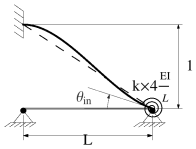
$$\frac{x_{\text{at max}}}{L} \approx \frac{0.42+0.33k}{1+k}$$

$$\frac{u_{\text{at max}}}{\theta_{\text{near}}\,L} \approx \frac{0.19+0.15k}{1+k}$$

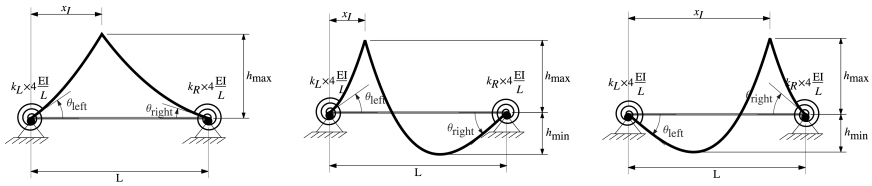
$$\frac{\theta_{\text{far}}}{\theta_{\text{near}}} = \frac{1}{2+2k}$$



$$\theta_{\text{in}} = \frac{3}{3+4\,k}\times\frac{1}{L}$$



$$\theta_{\text{in}} = \frac{3}{2+2\,k}\times\frac{1}{L}$$



(a) (b) (c)

$\frac{2\,k_L}{3+6\,k_L}L \le x_I \le \left(1-\frac{2\,k_R}{3+6\,k_R}\right)L$ $\Rightarrow$ influence line of bending moment has pattern of figure (a) above

$x_I \le \frac{2\,k_L}{3+6\,k_L}L$ $\Rightarrow$ influence line of bending moment has pattern of figure (b) above

$x_I \ge \left(1-\frac{2\,k_R}{3+6\,k_R}\right)L$ $\Rightarrow$ influence line of bending moment has pattern of figure (c) above

$$h_{\min} \approx \begin{cases} \frac{k_L}{1+k_L}\,\frac{(1+k_R)}{(5+7\,k_R)}\left(1-\frac{(x_I/L)}{2\,k_L/(3+6\,k_L)}\right)^2 L & 0 \le x_I \le \frac{2\,k_L}{3+6\,k_L}L \\ \frac{k_R}{1+k_R}\,\frac{(1+k_L)}{(5+7\,k_L)}\left(1-\frac{(1-(x_I/L))}{2\,k_R/(3+6\,k_R)}\right)^2 L & 1-\frac{2\,k_R}{3+6\,k_R} \le x_I \le L \end{cases}$$

$$\theta_{\text{left}} = \frac{(3+4\,k_R)-(3+6\,k_R)\,(x_I/L)}{3+4\,k_L+4\,k_R+4\,k_L\,k_R}$$

$$\theta_{\text{right}} = \frac{(3+4\,k_L)-(3+6\,k_L)\,(1-x_I/L)}{3+4\,k_L+4\,k_R+4\,k_L\,k_R}$$