Computation of the maximum frequency of the FEM model

First natural frequency (pin-pin boundary condition) as a function of the beam length:

$$\Omega_k = \left(\frac{k\pi}{L}\right)^2 \sqrt{\frac{EI}{m}} \quad \rightarrow \quad k = 1 \quad \rightarrow \quad f_1 = \frac{\Omega_1}{2\pi}$$

Lover first natural frequency of the beam:

$$\Omega_{1min} = \left(\frac{\pi}{L_{max}}\right)^2 \sqrt{\frac{EI}{m}} \quad \rightarrow \quad f_{1min} = \frac{\Omega_{1min}}{2\pi}$$

Maximum frequency of the analysis:

$$f_{max} \leq f_{1min} \quad \rightarrow \quad f_{max} = \frac{f_{1min}}{c} = \frac{\Omega_{1min}}{2\pi c} \qquad 1.5 \ \leq c \leq 3$$

With many beams types, given the properties and the maximum length of the j-th beam type, the maximum frequency of the analysis is:

$$\Omega_{1min,j} = \left(\frac{\pi}{L_{max,j}}\right)^2 \sqrt{\frac{EI_j}{m_j}} \quad \rightarrow \quad f_{max} = \frac{\min(\Omega_{1min,j})}{2\pi c}$$

Computation of the maximum length of each beam type

Given $\bar{f}_{max}$, the maximum frequency of the analysis:

$$\bar{\Omega}_{1min,j} = c2\pi\bar{f}_{max} \quad \rightarrow \quad L_{max,j} = \sqrt{\frac{\pi^2}{\bar{\Omega}_{1min,j}} \sqrt{\frac{EI_j}{m_j}}}$$