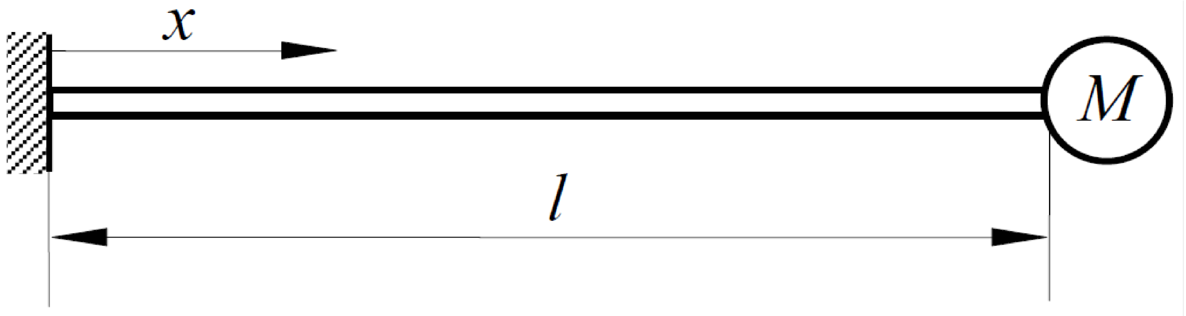


$\rho := 7800$

$E := 206000 \cdot 10^{6} = 2.06 \times 10^{11}$

$c := \sqrt{\frac{E}{\rho}} = 5139.091$

$M := 1.5$

$d := 10 \cdot 10^{-3} = 0.01$

$l := 750 \cdot 10^{-3} = 0.75$

$A_s := \frac{\pi \cdot d^2}{4} = 7.854 \times 10^{-5}$

$m_{barra} := \rho \cdot A_s \cdot l = 0.459$

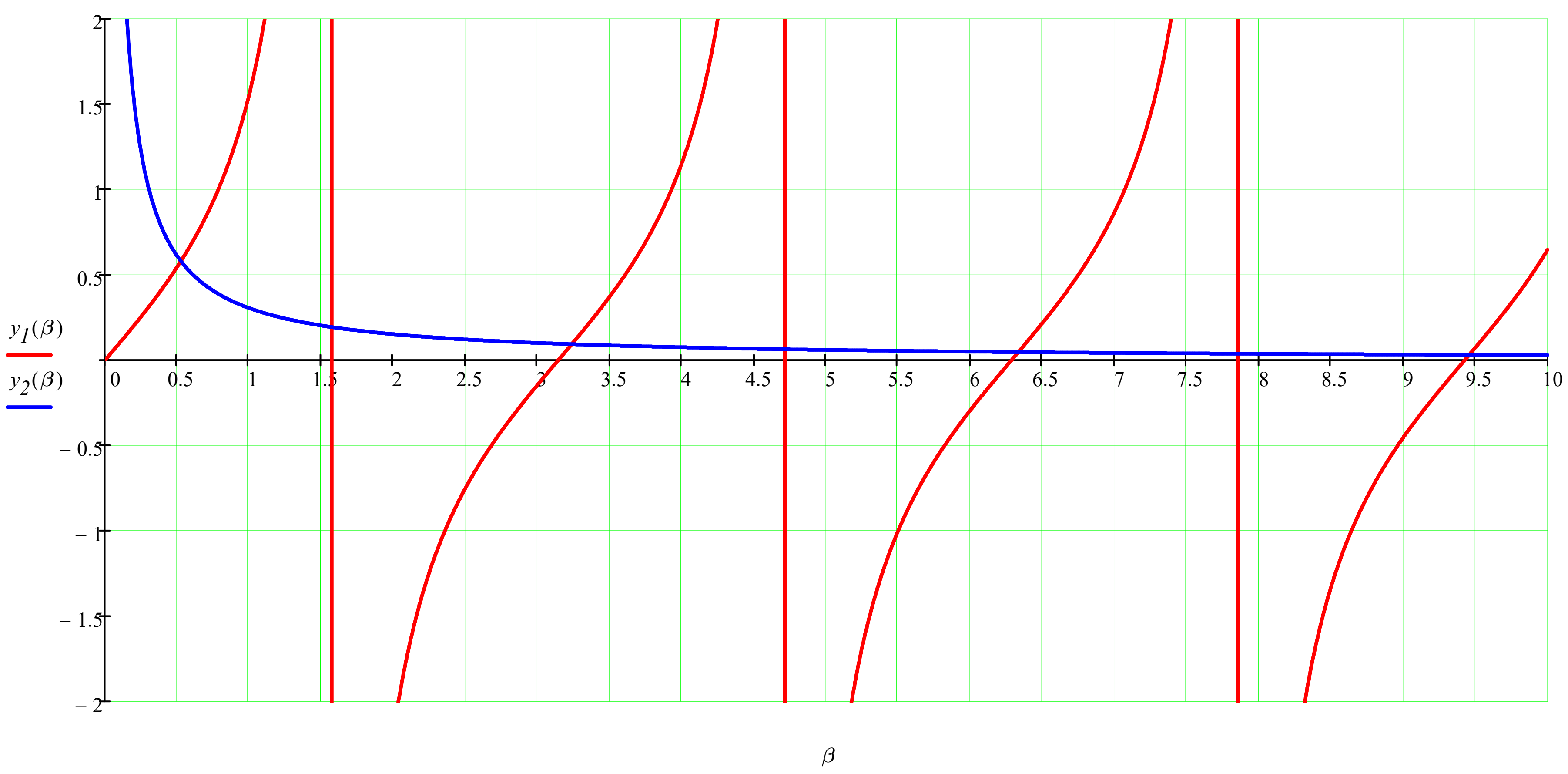
$h := \frac{m_{barra}}{M} = 0.306$

$tan(\beta) = \frac{h}{\beta}$

$y_1(\beta) := tan(\beta)$ $\qquad$ $y_2(\beta) := \frac{h}{\beta}$

$z(\beta) := tan(\beta) - \frac{h}{\beta}$

$\beta := 0.005, 0.010 .. 10$ $\qquad$ $FS := 2$



$\beta := 0.5$ $\qquad$ $\beta_1 := root(z(\beta), \beta) = 0.527$

$\beta := 3$ $\qquad$ $\beta_2 := root(z(\beta), \beta) = 3.236$

$\beta := 6$ $\qquad$ $\beta_3 := root(z(\beta), \beta) = 6.332$

$\beta := 9$ $\qquad$ $\beta_4 := root(z(\beta), \beta) = 9.457$

$$\begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{pmatrix} = \begin{pmatrix} 0.527 \\ 3.236 \\ 6.332 \\ 9.457 \end{pmatrix}$$

$$\omega := \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \end{pmatrix} \cdot \frac{c}{l} = \begin{pmatrix} 3609.189 \\ 22173.245 \\ 43384.38 \\ 64801.576 \end{pmatrix}$$ pulsazioni in rad/s

$$f := \frac{\omega}{2 \cdot \pi} = \begin{pmatrix} 574.42 \\ 3528.982 \\ 6904.839 \\ 10313.491 \end{pmatrix}$$ frequenze in Hz

Massa della barra trascurabile

$k := \frac{E \cdot A_s}{l} = 2.157 \times 10^7$

$\omega_{appr} := \sqrt{\frac{k}{M}} = 3792.297$

$f_{appr} := \frac{\omega_{appr}}{2 \cdot \pi} = 603.563$ Valore approssimato della frequenza propria (modello a parametri concentrati ad 1 gdl)

$f_1 = 574.42$ Valore esatto della prima frequenza propria (modello a parametri distribuiti)

$errore := \frac{f_{appr} - f_1}{f_1} = 5.073 \cdot \%$ Errore sulla prima frequenza propria