Risposta all'impulso unitario di un sistema vibrante a 1 GDL per condizioni iniziali nulle

$m := 5$ $\quad k := 2000$ $\quad \omega := \sqrt{\frac{k}{m}} = 20$ $\quad f := \frac{\omega}{2\cdot\pi} = 3.183$

Caso sottosmorzato

$c := 30$

$\xi := \frac{c}{2\cdot m\cdot\omega} = 0.15$

$\omega_s := \omega\cdot\sqrt{1-\xi^2} = 19.774$

$$x_1(t) := \begin{cases} 0 & \text{if } t < 0 \\ \left(\frac{e^{-\xi\cdot\omega\cdot t}}{m\cdot\omega_s}\cdot \sin(\omega_s\cdot t)\right) & \text{otherwise} \end{cases}$$

Caso con smorzamento critico

$c := 2\cdot m\cdot\omega = 200$

$\xi := \frac{c}{2\cdot m\cdot\omega} = 1$

$$x_2(t) := \begin{cases} 0 & \text{if } t < 0 \\ \frac{1}{m}\cdot t\cdot e^{-\omega\cdot t} & \text{otherwise} \end{cases}$$

Caso sovrasmorzato

$c := 250$

$\xi := \frac{c}{2\cdot m\cdot\omega} = 1.25$

$$\begin{pmatrix}\lambda_1\\ \lambda_2\end{pmatrix} := \begin{bmatrix}\omega\cdot\left(-\xi+\sqrt{\xi^2-1}\right)\\ \omega\cdot\left(-\xi-\sqrt{\xi^2-1}\right)\end{bmatrix} = \begin{pmatrix}-10\\ -40\end{pmatrix}$$

$$\begin{pmatrix}C_1\\ C_2\end{pmatrix} := \begin{bmatrix}\dfrac{-1}{m\cdot(\lambda_2-\lambda_1)}\\ \dfrac{1}{[m\cdot(\lambda_2-\lambda_1)]}\end{bmatrix} = \begin{pmatrix}6.667\times 10^{-3}\\ -6.667\times 10^{-3}\end{pmatrix}$$

$$x_3(t) := \begin{cases}0 & \text{if } t<0\\ C_1\cdot e^{\lambda_1\cdot t}+C_2\cdot e^{\lambda_2\cdot t} & \text{otherwise}\end{cases}$$

$t := -0.5, -0.499 .. 2$