Tecniche innovative per l'identificazione delle caratteristiche dinamiche delle strutture e del danno

La Valutazione delle Masse e delle Rigidezze

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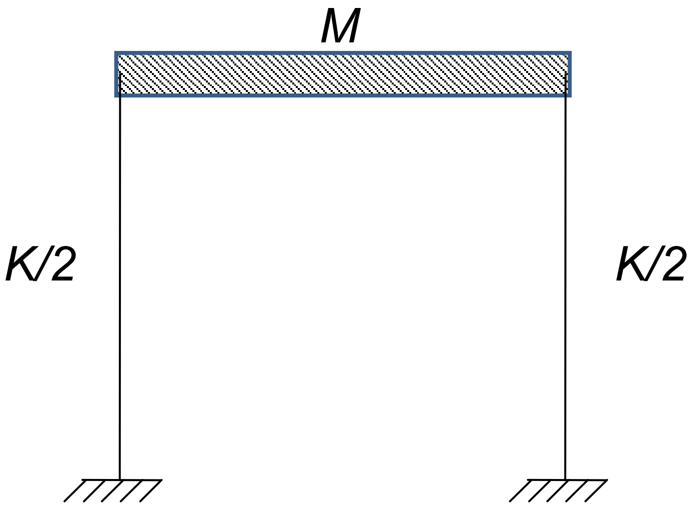
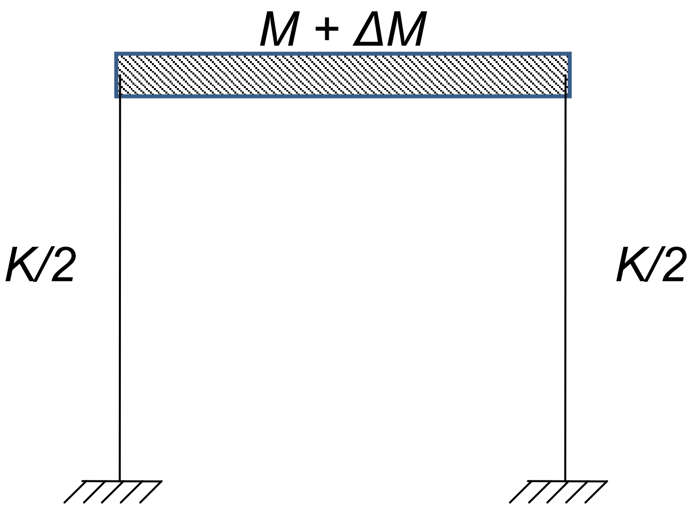
Tecniche di Identificazione dinamica



$$T_i = 2\pi\sqrt{\frac{M}{K}}$$



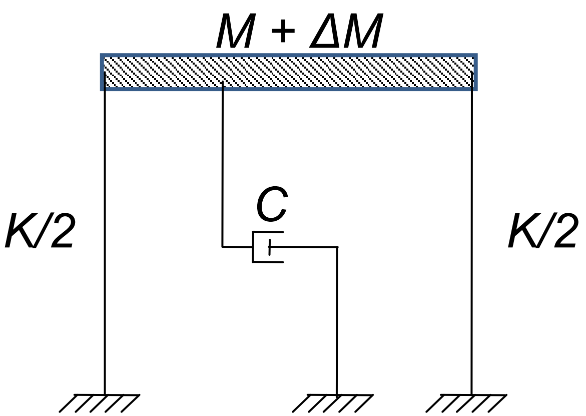
$$T_f = 2\pi\sqrt{\frac{M + \Delta M}{K}}$$

Tecniche di Identificazione dinamica

$$\begin{cases} T_i = 2\pi\sqrt{\dfrac{M}{K}} \\ T_f = 2\pi\sqrt{\dfrac{M+\Delta M}{K}} \end{cases}$$

$$M = \frac{T_i^2}{T_f^2 - T_i^2}\cdot \Delta M$$

$$K = \frac{4\cdot\pi^2}{T_f^2 - T_i^2}\cdot \Delta M$$



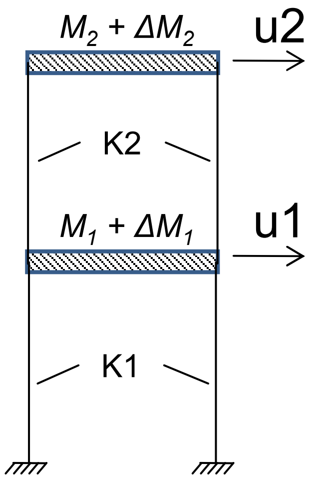
$$\begin{cases} T_{D,i} = \dfrac{1}{\sqrt{1-\zeta^2}}\cdot 2\pi\cdot\sqrt{\dfrac{M}{K}} \\ T_{D,f} = \dfrac{1}{\sqrt{1-\zeta^2}}\cdot 2\pi\cdot\sqrt{\dfrac{M+\Delta M}{K}} \end{cases}$$

$$M = \frac{T_{D,i}^2}{T_{D,f}^2 - T_{D,i}^2}\cdot \Delta M$$

$$K = \frac{1}{1-\zeta^2}\cdot\frac{4\cdot\pi^2}{T_{D,f}^2 - T_{D,i}^2}\cdot \Delta M$$

$$T_D = T \quad \Rightarrow \quad K = \frac{K_{ap}}{1-\zeta^2}$$

Tecniche di Identificazione dinamica



$$\begin{pmatrix} M_1 & 0 \\ 0 & M_2 \end{pmatrix}\begin{pmatrix} \ddot{u}_1 \\ \ddot{u}_2 \end{pmatrix} + \begin{pmatrix} K_1 + K_2 & -K_2 \\ -K_2 & K_2 \end{pmatrix}\begin{pmatrix} u_1 \\ u_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \qquad \det(\boldsymbol{K} - \lambda \boldsymbol{M}) = 0 \qquad \lambda_i = \omega_i^{\,2}$$

$$a\lambda^2 + b\lambda + c = 0 \qquad a_i = M_1 \cdot M_2 \qquad b_i = -M_1 \cdot K_2 - M_2 \cdot (K_1 + K_2) \qquad c_i = K_1 \cdot K_2$$

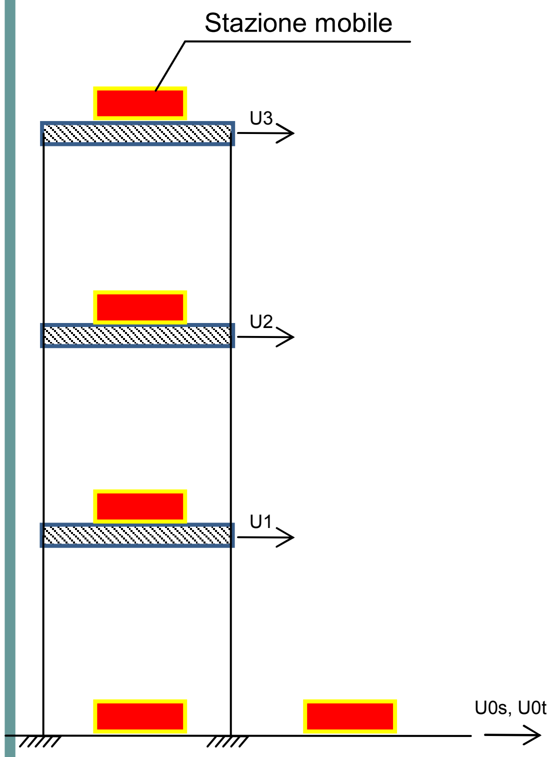
$$\lambda_{1,i} = \omega_{1,i}^2 = \frac{-b_i - \sqrt{b_i^{\,2} - 4 \cdot a_i \cdot c_i}}{2 \cdot a_i} \qquad \lambda_{2,i} = \omega_{2,i}^2 = \frac{-b_i + \sqrt{b_i^{\,2} - 4 \cdot a_i \cdot c_i}}{2 \cdot a_i}$$

$$\lambda_{1,f} = \omega_{1,f}^2 = \frac{-b_f - \sqrt{b_f^{\,2} - 4 \cdot a_f \cdot c_f}}{2 \cdot a_f} \qquad \lambda_{2,f} = \omega_{2,f}^2 = \frac{-b_f + \sqrt{b_f^{\,2} - 4 \cdot a_f \cdot c_f}}{2 \cdot a_f}$$

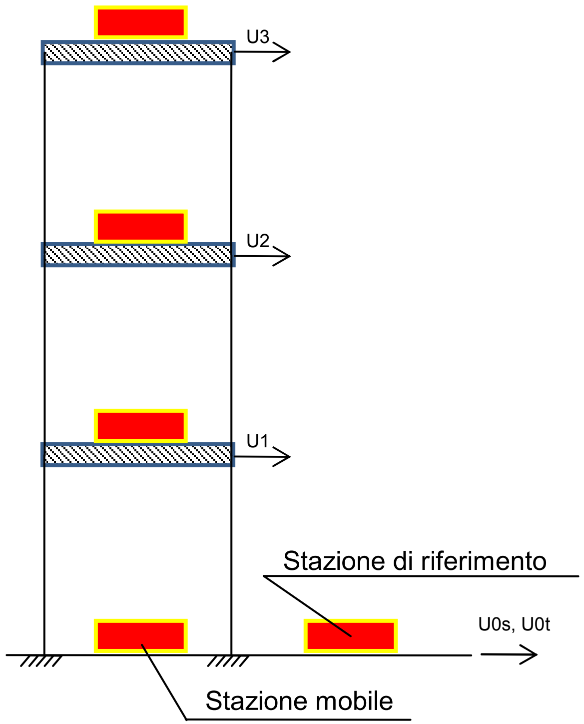
$$\begin{cases} \dfrac{-b_i - \sqrt{b_i^{\,2} - 4 \cdot a_i \cdot c_i}}{2 \cdot a_i} - \omega_{1,i}^2 = 0 \\[2ex] \dfrac{-b_i + \sqrt{b_i^{\,2} - 4 \cdot a_i \cdot c_i}}{2 \cdot a_i} - \omega_{2,i}^2 = 0 \\[2ex] \dfrac{-b_f - \sqrt{b_f^{\,2} - 4 \cdot a_f \cdot c_f}}{2 \cdot a_f} - \omega_{1,f}^2 = 0 \\[2ex] \dfrac{-b_f + \sqrt{b_f^{\,2} - 4 \cdot a_f \cdot c_f}}{2 \cdot a_f} - \omega_{2,f}^2 = 0 \end{cases} \Longrightarrow \begin{aligned} M_1 &= f(\Delta M_1, \Delta M_2, T_{1,i}, T_{2,i}, T_{1,f}, T_{2,f}) \\ M_2 &= f(\Delta M_1, \Delta M_2, T_{1,i}, T_{2,i}, T_{1,f}, T_{2,f}) \\ K_1 &= f(\Delta M_1, \Delta M_2, T_{1,i}, T_{2,i}, T_{1,f}, T_{2,f}) \\ K_2 &= f(\Delta M_1, \Delta M_2, T_{1,i}, T_{2,i}, T_{1,f}, T_{2,f}) \end{aligned}$$

Tecniche di Identificazione dinamica

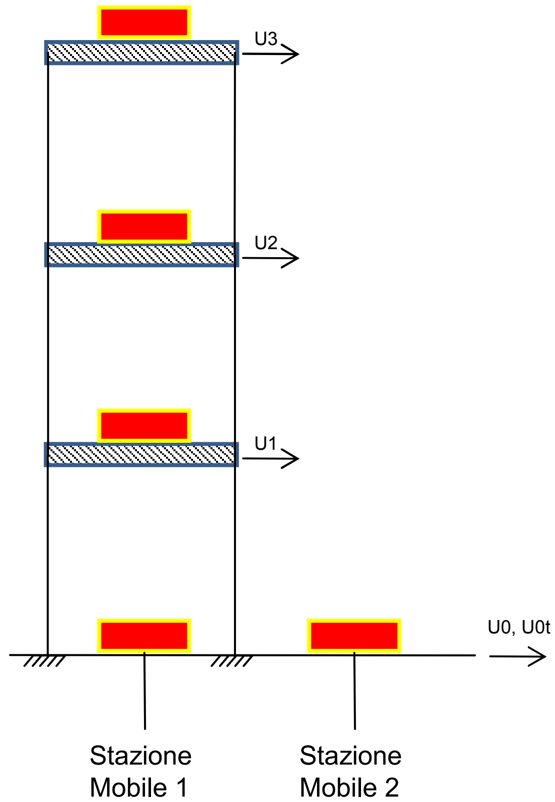
Configurazione 1



Configurazione 2



Configurazione 3



Tecniche di Identificazione dinamica

Configurazione 4