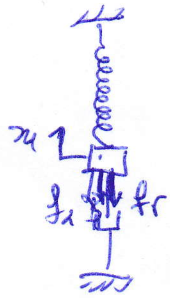
Solution de EMD1 Vibrations et ondes



Ex 1

à l'équilibre

$\sum \vec{F} = 0$ (1)

$\vec{P} + \vec{f}_r = 0 \Rightarrow -mg = kx_0$ (1)

en MVT $\sum \vec{F} = m\vec{\gamma}$ (1)

$\vec{P} + \vec{f}_r + \vec{f}_\alpha = m\vec{\gamma}$

par projection $-P - f_r - f_\alpha = m\gamma$ (1)

$-mg - k(x + x_0) - \alpha\dot{x} = m\gamma$

$-kx - \alpha\alpha = m\ddot{x}$ (1)

(1) $\ddot{x} + \frac{\alpha}{m}\dot{x} + \frac{k}{m}x = 0$ on pose $2\sigma = \frac{\alpha}{m}$; $\omega_0^2 = \frac{k}{m}$

(1) $\ddot{x} + 2\sigma\dot{x} + \omega_0^2 x = 0$ éq admet comme solution $x = e^{rt}$

$(r^2 + 2\sigma r + \omega_0^2)x = 0$ (1) $\Rightarrow r^2 + 2\sigma r + \omega_0^2 = 0$

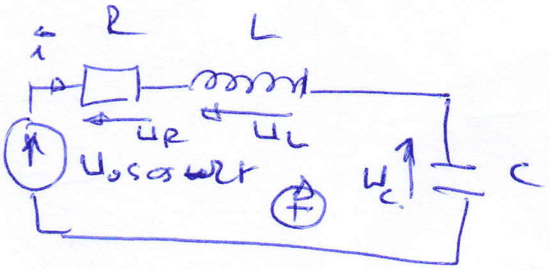
$\Delta' = \sigma^2 - \omega_0^2$ (1)

pour $\sigma < \omega \Rightarrow \Delta' < 0 \Rightarrow$ le mouvement et pseudamortie

la solution $x = Ae^{-\sigma t}(\cos\omega_D t + \varphi)$

(1) avec $\omega_D = \sqrt{-\Delta'} = \sqrt{\omega_0^2 - \sigma^2}$

Ex 2



d'après la la loi de Kirshuf $\sum u = 0$

$u - u_R - u_L - u_C = 0$ (1)

$u = u_R + u_L + u_C$

$Ri + L\frac{di}{dt} + \frac{q}{C} = u_0\cos\Omega t$ (1)

$i = \frac{dq}{dt} \Rightarrow L\ddot{q} + R\dot{q} + \frac{1}{C}q = u_0\cos\Omega t$

$\ddot{q} + \frac{R}{L}\dot{q} + \frac{1}{LC}q = \frac{u_0}{L}\cos\Omega t$ ... (1) (1)

$q = q_H + q_p$ q_H solution Homogène

q_p = " permanente

(1) on pose $\frac{R}{L} = 2\sigma$; $\omega_0^2 = \frac{1}{LC} \Rightarrow \ddot{q} + 2\sigma\dot{q} + \omega_0^2 q = \frac{u_0}{L}\cos\Omega t$