$$E_k = \tfrac{1}{2} m \dot{q}^2 \,; E_p = \tfrac{1}{2} k\, q^2 \,; \Phi = \tfrac{1}{2} c\, \dot{q}^2 \,; L = F\, q$$

$$d_{ij} = \int_u \frac{M_i M_j}{EJ} ds + \left\{ \int_u \frac{N_i N_j}{EA} ds \right\}$$

$$\int_a^b f(x) g(x) dx =$$

$$= \frac{b-a}{6} \left[f(a) g(a) + 4\, f\left(\tfrac{a+b}{2}\right) g\left(\tfrac{a+b}{2}\right) + f(b) g(b) \right]$$

$$m \ddot{q} + k\, q = 0$$

$$\omega = \sqrt{k/m} = 2\pi\, f = 2\pi / T$$

$$q(t) = q_s \sin\, \omega t + q_c \cos\, \omega t = a\, \sin(\omega t + \varphi);$$

$$a = \mathrm{am}\, q = \sqrt{q_s^2 + q_c^2}; \quad \varphi = \arctan\left(q_c / q_s\right)$$

$$q_s = a \cos \varphi, \qquad q_c = a \sin \varphi$$

$$m \ddot{q} + c\, \dot{q} + k\, q = 0$$

$$\omega' = \omega \sqrt{1 - \alpha^2} = 2\pi\, f' = 2\pi / T'$$

$$\alpha = \frac{c}{2\sqrt{k\, m}}$$

$$\vartheta = \ln \frac{q(t)}{q(t + T')} = \frac{1}{n} \ln \frac{q(t)}{q(t + n\, T')} =$$

$$= \alpha\, \omega T' = 2\pi\, \alpha \Big/ \sqrt{1 - \alpha^2} \approx 2\pi\, \alpha$$

$$\alpha = \vartheta \Big/ \sqrt{4\pi^2 + \vartheta^2} \approx \vartheta / 2\pi$$

$$q(t) = e^{-\alpha\, \omega t} \left(q_s \sin \omega' t + q_c \cos \omega' t \right) =$$

$$= a\, e^{-\alpha\, \omega t}\, \sin(\omega' t + \varphi)$$

$$m \ddot{q} + c\, \dot{q} + k\, q = F(t) = F_s \sin pt + F_c \cos pt$$

$$q(t) = \frac{\nu}{k} F_s \sin(pt - \psi) + \frac{\nu}{k} F_c \cos(pt - \psi)$$

$$\mathrm{am}\, q = \frac{\nu}{k} \sqrt{F_s^2 + F_c^2} = \frac{\nu}{k} \mathrm{am}\, F$$

$$\nu = \frac{1}{\sqrt{\left(1 - \eta^2\right)^2 + 4\alpha^2 \eta^2}}$$

$$\psi = \arctan \frac{2\alpha\eta}{1 - \eta^2}, \qquad \eta = \frac{p}{\omega}$$

$$\nu_T = \nu' = \frac{\sqrt{1 + 4\alpha^2 \eta^2}}{\sqrt{\left(1 - \eta^2\right)^2 + 4\alpha^2 \eta^2}}$$