EPFL

FORM MICRO-372

Harmonic oscillator eigenfrequency (linear motion): $f = \frac{1}{2\pi}\sqrt{\frac{K}{M}}$

Harmonic oscillator eigenfrequency (angular motion): $f = \frac{1}{2\pi}\sqrt{\frac{K_\theta}{J}}$

Grübler modified criterion in 2D: $DOF_e + DOF_i = \sum Mo_i - 3L + OC$

Grübler modified criterion in 3D: $DOF_e + DOF_i = \sum Mo_i - 6L + OC$

Kibble balance static mode equation: $mg = BLI$

Kibble balance static mode equation: $U = BLv$

Kibble balance virtual powers equation: $mgv = UI$

Dynamic pressure: $q = \frac{1}{2}\rho v^2$

Euler-Bernoulli beam model: $\ddot{y} = -\frac{M}{EI}$

Tangential and secant stiffnesses: $K_{tan} = \frac{dF}{dx}$ and $K_{sec} = \frac{F}{x}$

Elastic energy and force (Hook's law): $E_{el} = \int F(x)dx = \frac{1}{2}Kx^2$ and $F = Kx$

Stiffness addition of spring in series: $\frac{1}{K_{equ}} = \frac{1}{K_1} + \frac{1}{K_2}$

Stiffness addition of spring in parallel: $K_{equ} = K_1 + K_2$

Stiffness conversion (rotative to linear): $K_{rot} = r^2 K_{lin}$

Buckling load of a beam (both ends fixed): $F_{buck} = \frac{4\pi^2 EI}{L^2}$

Surface inertia of a beam: $I_y = \frac{bh^3}{12}$

Mile's formula: $G_{RMS} = \sqrt{\frac{\pi}{2} \cdot f_n \cdot Q \cdot ASD_{f_n}}$

Force 3σ: $F_{3\sigma} = 3MG_{RMS}$

Euler second law: $\sum M = J\ddot{\theta}$

Quality factor: $Q = 2\pi \frac{E_{tot}}{E_{lossPerCycle}}$

Damping ratio: $\zeta = \frac{c}{2m\omega}$

Loss factor: $\eta = \frac{1}{Q} = 2\zeta$

Lagrangian: $L = T - V$

Kinetic energy: $T = \frac{1}{2}mv^2 + \frac{1}{2}J\omega^2$

Gravitational potential energy: $V = mgh$

Elastic potential energy: $V = \frac{1}{2}Kx^2$

Euler-Lagrange equation: $\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}}\right) = \frac{\partial L}{\partial q}$