FORMULÁRIO

Física 1 - MIEA

Constantes úteis

$$g = 9,81 \text{ m/s}^2 \qquad v_{\text{som}} = 340 \text{ m/s} \qquad p_{\text{atm}} = 1 \text{ atm } = 101,3 \text{ kPa}$$

Cinemática

$$\boldsymbol{v} = \frac{d\boldsymbol{r}}{dt}, \qquad \boldsymbol{a} = \frac{d\boldsymbol{v}}{dt} = \frac{d^2\boldsymbol{r}}{dt^2} \; ; \qquad \text{r}(t_1) = \boldsymbol{r}_0 + \int_0^{t_1} \boldsymbol{v} dt \; ; \qquad \text{v}(t_1) = \boldsymbol{v}_0 + \int_0^{t_1} \boldsymbol{a} dt \; .$$

$$\boldsymbol{v}(t) = \boldsymbol{v}_0 + \boldsymbol{a}t \; ; \qquad \boldsymbol{r}(t) = \boldsymbol{r}_0 + \boldsymbol{v}_0 t + \frac{1}{2}\boldsymbol{a}t^2 \qquad v^2 = v_0^2 + 2a(x - x_0) \; .$$

$$v = \omega r \; , \qquad a = \frac{v^2}{r} \; , \qquad \omega = 2\pi f = \frac{2\pi}{T}$$

Dinâmica

$$\boldsymbol{F} = m\boldsymbol{a} \qquad F = -kx \qquad \boldsymbol{p} = m\boldsymbol{v} \qquad |\boldsymbol{f}_s| \leq \mu_s |\boldsymbol{R}_N| \qquad |\boldsymbol{f}_s| = \mu_k |\boldsymbol{R}_N| \qquad \boldsymbol{F}_{AB} = -\boldsymbol{F}_{BA}$$

Trabalho e Energia

$$W_F = \int F(x) dx \qquad W_F = \int \boldsymbol{F} \cdot \boldsymbol{r} \qquad \Delta E_p = -\int \boldsymbol{F}_{\text{cons.}} \cdot d\boldsymbol{r}$$

$$E_c = \frac{1}{2}mv^2 \qquad E_{pg} = mgh \qquad E_{pe} = \frac{1}{2}kx^2 \qquad F_x = -\frac{dE_p}{dx}$$

$$W = E_{c,f} - E_{c,i} \qquad E_c + E_p = E_m \qquad W_{\text{ext}} = \Delta E_m + W_{f_k} + \Delta E_{\text{outras}}$$

Sistemas de partículas

$$\boldsymbol{R}_{\text{CM}} = \frac{1}{M}\sum m_i \boldsymbol{r}_i \qquad \boldsymbol{V}_{\text{CM}} = \frac{d\boldsymbol{R}_{\text{CM}}}{dt} = \frac{1}{M}\sum m_i \boldsymbol{v}_i$$

$$\boldsymbol{P} = \sum_i m_i \boldsymbol{v}_i \qquad \boldsymbol{F}^{\text{ext}} = \frac{d\boldsymbol{P}}{dt} = M\boldsymbol{A}_{\text{CM}}$$

$$E_c = \frac{1}{2}MV_{CM}^2 + \sum_i \frac{1}{2}m_i u_i^2 \qquad \boldsymbol{u}_i = \boldsymbol{v}_i - \boldsymbol{V}_{CM} \qquad \boldsymbol{I} = \int_{t_1}^{t_2} \boldsymbol{F} dt = \boldsymbol{p}_2 - \boldsymbol{p}_1 \qquad \boldsymbol{F} = \frac{\boldsymbol{I}}{\Delta t} \; .$$

$$I = \sum_i m_i r_i^2 \qquad \boldsymbol{L} = \sum_i \boldsymbol{r}_i \times \boldsymbol{p}_i \qquad \boldsymbol{\tau} = \sum_i \boldsymbol{r}_i \times \boldsymbol{F}_i$$

Rotação e Corpo Rígido

$$\omega = \frac{d\theta}{dt} \qquad \alpha = \frac{d\omega}{dt} = \frac{d^2\theta}{dt^2}$$

$$\omega = \omega_0 + \alpha t \qquad \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2 \qquad \omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

$$I = \int r^2 dm \qquad \tau^{\text{ext}} = I\alpha \qquad L = I\omega \qquad \tau_{\text{ext}} = \frac{dL}{dt}$$

$$E_c^{\text{rot}} = \frac{1}{2}I\omega^2 \qquad E^{\text{total}} = E_c^{\text{rot}} + \frac{1}{2}MV_{CM}^2 \qquad W = \tau\Delta\theta$$

$$I = I_{\text{CM}} + Md^2$$

Momentos de inércia

$I = \frac{1}{12}Ml^2$ (Barra delgada de comprimento l, eixo no centro perpendicular ao eixo da barra);

$I = MR^2$ (Anel de raio R, eixo perpendicular ao disco que passa no seu centro);

$I = \frac{1}{2}MR^2$ (Cilindro de raio R, eixo coincidente com o eixo do cilindro);

$I = \frac{2}{5}MR^2$ (Esfera de raio R, eixo a passar no centro).

Hidrostática

$$\rho = \frac{m}{V}\,, \qquad p = \frac{dF}{dA}\,, \qquad p = p_0 + \rho g h\,, \qquad B = \rho V g$$

Ondas

$$y(x,t) = A\cos(\omega t - kx) \qquad v = \frac{\lambda}{T} \qquad k = \frac{2\pi}{\lambda} \qquad \omega = \frac{2\pi}{T} \qquad v = \sqrt{\frac{\mathcal{T}}{\mu}} \qquad u(x,t) = \frac{\partial y}{\partial t}\,.$$

$$I = \overline{P} = \frac{1}{2}\mu v\omega^2 A^2 \qquad I = 4I\cos^2\left(\frac{\delta}{2}\right) \qquad \delta = 2\pi\frac{\Delta x}{\lambda}$$

$$y(x,t) = 2A\cos\left(\frac{\Delta\omega}{2}t - \frac{\Delta k}{2}x\right)\cos\left(\overline{\omega}t - \overline{k}x\right) \qquad v_\varphi = \frac{\overline{\omega}}{\overline{k}} \qquad v_{\text{g}} = \frac{\Delta\omega}{\Delta k}$$

$$y_n(x,t) = 2A\cos(\omega_n t)\sin(k_n x) \qquad f_n = nf_1 = n\frac{v}{2L} \;\; n = 1,2,... \qquad f_n = nf_1 = n\frac{v}{4L} \;\; n = 1,3,5...\,.$$

$$v = \sqrt{\frac{B}{\rho}} \qquad p_0 = \rho\omega v s_0 \qquad v = \sqrt{\frac{\gamma P_0}{\rho_0}} = \sqrt{\frac{\gamma R}{M}T}$$

$$I = \frac{p_0^2}{2v\rho} \qquad I = \frac{\overline{P}}{4\pi r^2} \qquad \beta = (10\text{ dB})\log_{10}\left(\frac{I}{I_0}\right)\,, \qquad I_0 = 10^{-12}\text{ W m}^{-2}$$

$$f_{\text{o}} = \frac{1}{1 \pm \frac{u_s}{v}}f_s \qquad f_{\text{o}} = \left(1 \pm \frac{u_{\text{o}}}{v}\right)f_s \qquad f_{\text{o}} = \frac{1 \pm \frac{u_{\text{o}}}{v}}{1 \pm \frac{u_s}{v}}f_s\,.$$