Physics 1 - Ultimate Cheatsheet

29 settembre 2025

1 Calcolo vettoriale

1. $\vec{v} + \vec{w} = (v_x + w_x)\hat{\imath} + (v_y + w_y)\hat{\jmath} + (v_z + w_z)\hat{k}$;
2. $\vec{v} = \vec{w} \Leftrightarrow v_x = w_x, \quad v_y = w_y, \quad v_z = w_z$;
3. $\lambda\vec{v} = \lambda v_x\hat{\imath} + \lambda v_y\hat{\jmath} + \lambda v_z\hat{k}$;
4. $\vec{v} \cdot \vec{w} = v_x w_x + v_y w_y + v_z w_z$;
5. $\vec{v} \cdot \vec{v} = v^2 = v_x^2 + v_y^2 + v_z^2$;
6. $$\vec{v} \times \vec{w} = \det \begin{pmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ v_x & v_y & v_z \\ w_x & w_y & w_z \end{pmatrix}$$

$$\begin{cases} \vec{v} = \dot{s}\hat{u}_t \\ \vec{a} = \ddot{s}\hat{u}_t + \frac{\dot{s}^2}{\rho}\hat{u}_n \end{cases}$$

2 Cinematica

2.1 Moti uniformi

$$\dot{s}_0(t - t_0) + s_0$$

2.2 Moti uniformemente vari

$$\begin{cases} \dot{s} = \ddot{s}_0(t - t_0) + \dot{s}_0 \\ s = \frac{1}{2}\ddot{s}_0(t - t_0)^2 + \dot{s}_0(t - t_0) + s_0 \end{cases}$$

2.3 Moti rettilinei

$$x(t) = v_0 t + x_0$$

2.4 Moto circolare uniforme

$$\begin{cases} \vec{r} = R\cos(\omega t) + R\sin(\omega t)\hat{\jmath} \\ \vec{v} = -\omega R\sin(\omega t)\hat{\imath} + \omega R\cos(\omega t) = \omega R\hat{u}_t \\ \vec{a} = -\omega^2 R\cos(\omega t)\hat{\imath} - \omega^2 R\sin(\omega t)\hat{\jmath} = -\omega^2\vec{r} \end{cases}$$

2.5 Moto circolare uniformemente vario

$$s(t) = \frac{1}{2}a_0(t - t_0)^2 + v_0(t - t_0) + s_0$$
$$\theta(t) = \frac{1}{2}\frac{a_0}{R}(t - t_0)^2 + \frac{v_0}{R}(t - t_0) + \theta_0$$

2.6 Grandezze angolari

$$\vec{\alpha}(t) = \frac{d\vec{\omega}}{dt} = \frac{d\omega}{dt}\hat{k} = \ddot{\theta}\hat{k}$$
$$\vec{a} = \vec{\alpha} \times \vec{r} + \vec{\omega} \times (\vec{\omega} \times \vec{r})$$

$$\begin{cases} x(t) = A\cos(\omega_0 t + \phi_0) \\ v_x = \dot{x} = -\omega_0 A\sin(\omega t + \phi_0) \\ a_x = \ddot{x} = -\omega_0^2 A\cos(\omega_0 t + \phi_0) = -\omega_0^2 x \end{cases}$$

2.7 Moti relativi

$$\vec{r} = \vec{r'} + \vec{R}$$
$$\vec{v} = \vec{v'} + \left(\frac{d\vec{R}}{dt}\right)_S + \vec{\omega} \times (\vec{r} - \vec{R})$$
$$\vec{a} = \vec{a'} + \left(\frac{d^2\vec{R}}{dt^2}\right)_S + \vec{\alpha} \times (\vec{r} - \vec{R}) +$$
$$\vec{\omega} \times (\vec{\omega} \times (\vec{r} - \vec{R})) + 2\vec{\omega} \times \vec{v'}$$
$$\vec{v_t} = \left(\frac{d\vec{R}}{dt}\right)_S + \vec{\omega} \times (\vec{r} - \vec{R})$$
$$\vec{a_t} = \left(\frac{d^2\vec{R}}{dt^2}\right)_S + \vec{\alpha} \times (\vec{r} - \vec{R}) +$$
$$\vec{\omega} \times (\vec{\omega} \times (\vec{r} - \vec{R}))$$
$$\overrightarrow{a_{co}} = 2\vec{\omega} \times \vec{v'}$$
$$m\vec{a'} = \vec{F} + \vec{F_t} + \overrightarrow{F_{co}}$$
$$\vec{F_t} = -m\vec{a_t}$$
$$\overrightarrow{F_{co}} = -2m\vec{\omega} \times \vec{v'}$$

3 Principi della dinamica

A EXTRA