Koninklijk Atheneum Vilvoorde

Formules en Constanten Fysica revisie 1.3

Inhoudsopgave

1 Eendimensionale beweging

1.1 ERB

$$\Delta s = v \cdot \Delta t$$

1.2 EVRB

$$\Delta s = v_0 \cdot \Delta t + \frac{1}{2} a \cdot (\Delta t)^2$$

$$v = \frac{ds}{dt} = v_0 + a \cdot \Delta t$$

$$a = \frac{dv}{dt}$$

$$\langle v \rangle = \frac{\Delta s}{\Delta t}$$

1.2.1 Vrije Val

$$\Delta h = \frac{1}{2} g \cdot (\Delta t)^2$$

$$v = \frac{dh}{dt} = g \cdot \Delta t$$

(voor België)

$$g = 9.81 m/s^2 = 9.81 m \cdot s^{-2}$$

1.2.2 Verticale Worp

Naar boven

$$\Delta h = v_0 \cdot \Delta t - \frac{1}{2} g \cdot (\Delta t)^2$$

$$v = \frac{dh}{dt} = v_0 - g \cdot \Delta t$$

$$\Delta t_{stijg} = \frac{v_0}{g}$$

$$h_{max} = \frac{v_0^2}{2g}$$

Naar beneden

$$\Delta h = v_0 \cdot \Delta t + \frac{1}{2} g \cdot (\Delta t)^2$$

$$v = \frac{dh}{dt} = v_0 + g \cdot \Delta t$$

$$\Delta t_{daal} = \frac{v_0}{g}$$

$$h_{max} = \frac{v_0^2}{2g}$$

2 Tweedimensionale Beweging

2.1 Horizontale Worp

Verticaal analoog aan de vrije val (cfr. 1.2.1 op p. 3)

$$\Delta h = \frac{1}{2} g \cdot (\Delta t)^2$$

$$\Delta t_{val} = \sqrt{\frac{2h}{g}}$$

Horizontaal analoog aan de ERB (cfr. 1.1 op p. 3)

$$\Delta s = v_0 \cdot \Delta t = v_0 \cdot \sqrt{\frac{2h}{g}}$$

Algemeen

$$h = \frac{1}{2} \cdot \frac{g}{v_0^2} \cdot (\Delta s)^2$$

2.2 Schuine Worp

Algemeen

$$v_{0,h} = v_0 \cdot \cos\theta$$

$$v_{0,v} = v_0 \cdot \sin\theta$$

Verticaal analoog aan de verticale worp (cfr. 1.2.2 op p. 3) met $v_0 = v_{0,v}$

$$\Delta t_{stijg} = \Delta t_{daal} = \frac{v_{0,v}}{g} \Leftrightarrow \Delta t_{totaal} = 2\frac{v_{0,v}}{g}$$

Horizontaal analoog aan de ERB (cfr. 1.1 op p. 3) met $v_0 = v_{0,h}$

$$\Delta s = v_{0,h} \cdot 2\Delta t = \frac{2 \cdot v_{0,h} \cdot v_{0,v}}{g}$$

2.3 ECB

$$f = \frac{1}{T}$$

$$\omega = \frac{\theta}{\Delta t} = 2\pi f = \frac{2\pi}{T}$$

$$\vec{r} : \begin{cases} x = r\cos\theta = r\cos(\omega t) \\ y = r\sin\theta = r\sin(\omega t) \end{cases} \Leftrightarrow \vec{r} = x \cdot \vec{e}_x + y \cdot \vec{e}_y = r\cos(\omega t) \cdot \vec{e}_x + r\sin(\omega t) \cdot \vec{e}_y$$

$$\vec{v} : \begin{cases} v_x = \frac{dx}{dt} = -r\omega\sin(\omega t) \\ v_y = \frac{dy}{dt} = r\omega\cos(\omega t) \end{cases} \Leftrightarrow v = |\vec{v}| = \sqrt{v_x^2 + v_y^2} = \sqrt{r^2\omega^2\left[\sin^2(\omega t) + \cos^2(\omega t)\right]} = r\omega$$

$$\vec{a} : \begin{cases} a_x = \frac{dv_x}{dt} = -r\omega^2\cos(\omega t) \\ a_y = \frac{dv_y}{dt} = -r\omega^2\sin(\omega t) \end{cases} \Leftrightarrow \vec{a} = a_x \cdot \vec{e}_x + a_y \cdot \vec{e}_y = -\omega^2\left[r\cos(\omega t) \cdot \vec{e}_x + r\sin(\omega t) \cdot \vec{e}_y\right] = -\omega^2 \cdot \vec{r}$$

$$a_c = |\vec{a}| = \omega^2 \cdot r = a_{centripetaal} = \frac{v^2}{r} = a_{centrifugaal}$$

$$\vec{F_c} = m \cdot \vec{a}_c \Leftrightarrow F_c = m \cdot a_c = m \cdot \frac{v^2}{r}$$

3 Krachtwerking

Krachten

$$\vec{F} = m \cdot \vec{a} \Leftrightarrow F = m \cdot a$$

$$\vec{F}_{1,2} = -\vec{F}_{2,1} \Leftrightarrow F = F'$$

Arbeid

$$W = \vec{F} \cdot \Delta\vec{s} = \vec{F} \cdot \Delta\vec{r}$$

$$dW = \vec{F} \cdot d\vec{r}$$

$$W_{a \to b} = \int_a^b dW = \int_a^b \vec{F} \cdot d\vec{r}$$

Vermogen

$$\langle P \rangle = \frac{W}{\Delta t}$$

$$P = \frac{dW}{dt} = \frac{\vec{F} d\vec{r}}{dt} = \vec{F} \cdot \vec{v}$$

Energie

$$E_p = m \cdot g \cdot h$$

$$E_k = \frac{1}{2} \cdot m \cdot v^2$$

$$W = \Delta E_k = -\Delta E_p$$

$$E_m = E_k + E_p$$

Impuls

$$p = m \cdot v$$

Krachtstoot

$$\vec{I}_{a \to b} = \int_a^b \vec{F} dt = \int_a^b d\left(m \cdot \vec{v}\right) = \Delta\vec{p}$$

4 Harmonische Trillingen

algemeen kenmerk van een harmonische trilling

$$\vec{F} = -k\Delta\vec{s}$$

basisformules

$$T = \frac{1}{f} = \frac{\Delta t}{\Delta n}$$

$$\omega = \frac{\Delta\theta}{\Delta t} = 2\pi f = \frac{2\pi}{T}$$

Wiskundige Harmonische Trillingen

$$\vec{s}_t = \vec{A}\sin(\omega t + \varphi_0)$$

$$\vec{v}_t = \frac{d\vec{s}_t}{dt} = \omega\vec{A}\cdot\cos(\omega t + \varphi_0)$$

$$\vec{a}_t = \frac{d\vec{v}_t}{dt} = -\omega^2\vec{A}\cdot\sin(\omega t + \varphi_0) = -\omega^2 s_t$$

Gedempte Trillingen

$$\vec{s}_t = e^{-k_d t}\cdot\vec{A}\sin(\omega t + \varphi_0)$$

$$\vec{v}_t = \frac{d\vec{s}_t}{dt} = e^{-k_d t}\cdot\omega\vec{A}\cdot\cos(\omega t + \varphi_0)$$

$$\vec{a}_t = \frac{d\vec{v}_t}{dt} = -e^{-k_d t}\cdot\omega^2\vec{A}\cdot\sin(\omega t + \varphi_0) = -\omega^2 s_t$$

Periode van een veer

$$T = 2\pi\sqrt{\frac{m}{k_v}}$$

Periode van een slinger

$$T = 2\pi\sqrt{\frac{l}{g}}$$

Zwevingen

$$\omega = \frac{\omega_1 + \omega_2}{2}$$

$$p = \frac{\omega_1 - \omega_2}{2}$$

$$s = 2A\cos pt\cdot\sin\omega t$$

$$f_z = f_1 - f_2$$

5 Golven

$$\lambda = vT \Leftrightarrow v = \lambda f$$

$$s_P = A \sin 2\pi \left(\frac{t}{T} - \frac{d}{\lambda} \right)$$

Interferentie

$$s_P = 2A \cos \pi \left(\frac{d' - d}{\lambda} \right) \cos 2\pi \left(\frac{t}{T} - \frac{d' + d}{\lambda} \right)$$

6 Geluidsleer

$$p = p_0 \sin\left(\omega t - \frac{2\pi d}{\lambda}\right)$$

$v_{geluidinlucht0^\circ C} = 331 m/s$

$v_{geluidinlucht15^\circ C} = 340 m/s$