Oppervlaktespanning

$$\boldsymbol{opp.spanning}: \gamma = \frac{F}{l} = \frac{F}{2L} = \frac{W}{\Delta A}$$

$$\boldsymbol{Young - Laplace}: \begin{matrix} \Delta P = P_2 - P_1 = \dfrac{2\gamma}{R}(waterdrp) \\ \Delta P = P_3 - P_1 = \dfrac{4\gamma}{R}(zeepbel) \end{matrix}$$

$$\boldsymbol{Yurin}: \begin{matrix} 2\pi R\gamma cos\theta = mg = \rho\pi R^2 hg \\ \Rightarrow h = \dfrac{2\gamma cos\theta}{\rho R g} \end{matrix}$$

Trilling

$$\boldsymbol{Harmonische\ oscillator}: \frac{d^2x}{dt^2} + \frac{k}{m}x = 0$$

$$\Rightarrow x(t) = Acos(\omega t + \phi)\ met\ \omega = \sqrt{\frac{k}{m}}$$

$$\Rightarrow A = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2}\ ;\ \phi = Bgtan\left(\frac{-v_0}{x_0\omega}\right)$$

$$\Rightarrow T = \frac{2\pi}{\omega}\ ; f = \frac{\omega}{2\pi} \Leftrightarrow \omega = 2\pi f$$

$$\boldsymbol{Energie}: \begin{matrix} U = \dfrac{1}{2}kx^2 = \dfrac{1}{2}k\,A^2cos^2(\omega t + \phi) \\ U = \dfrac{1}{2}mv^2 = \dfrac{1}{2}k\,A^2sin^2(\omega t + \phi) \end{matrix}$$

$$\Rightarrow E = K + U = \frac{1}{2}kA^2$$

$$\Rightarrow v_{max} = A\omega \Rightarrow v = \pm v_{max}\sqrt{1 - \frac{x^2}{A^2}}$$

$$\boldsymbol{Wiskundige\ slinger}: \frac{d^2\theta}{dt^2} + \omega^2\theta = 0$$

$$\Rightarrow \theta = \theta_0 cos(\omega t + \phi)\ met\ \omega = \sqrt{\frac{g}{l}}$$

$$\boldsymbol{Gedempte\ harmonische\ trilling}: \begin{matrix} F_d = -bv \\ \dfrac{d^2x}{dt^2} + \dfrac{b}{m}\dfrac{dx}{dt} + \omega_0^2\theta = 0\ b\ met\omega_0^2 = \dfrac{k}{m} \end{matrix}$$

$$\textbf{\textit{Gedwonge harmonische trilling}}: \begin{array}{c} F_{ext} = F_0 cos\omega t \\ m\frac{d^2x}{dt^2} + b\frac{dx}{dt} + m\omega_0^2\theta = F_0 cos\omega t \end{array}$$

Golven

$$v = \frac{\lambda}{T} = \lambda f = \sqrt{\frac{F_T}{\mu}} = \sqrt{\frac{B}{\rho}}$$

$$\bar{P} = \frac{E}{t} \Rightarrow I = \frac{\bar{P}}{S}$$

$$\textbf{\textit{Golf}}: D(x,t) = Asin\big(k(x - vt)\big) = Asin(kx - \omega t)$$

$$\Rightarrow k = \frac{2\pi}{\lambda} \Rightarrow v = \frac{\omega}{k}$$

$$\textbf{\textit{Golfvergelijking}}: \frac{\partial^2 D}{\partial x^2} - \frac{1}{v^2}\frac{\partial^2 D}{\partial t^2} = 0$$

$$v_{deeltje} = \frac{\partial D}{\partial t} = -\omega Acos(kx - \omega t)$$

$$\textbf{\textit{Staande Golf}}: \begin{array}{c} D_1(x,t) = Asin(kx - \omega t) \\ D_2(x,t) = Asin(kx + \omega t) \end{array}$$

$$\Rightarrow D = D_1 + D_2 = 2Asin(kx)\cos(\omega t)$$

$$f_n = \frac{v}{\lambda_n} = n\frac{v}{2l}$$

Geluid

$$\textbf{\textit{Drukgolf}}: P(x,t) = -B\frac{\partial D(x,t)}{\partial x} = -BAkcos(kx - \omega t) = BkAsin\left(kx - \omega t - \frac{\pi}{2}\right)$$

$$\Rightarrow P(x,t) = P_M sin\left(kx - \omega t - \frac{\pi}{2}\right)$$

$$\textbf{\textit{Intensiteit}}: \beta(dB) = 10\log\left(\frac{I}{I_0}\right)$$

$$\textbf{\textit{Blaasinstrumenten}}: \begin{array}{c} Open\ buis: f_n = n\frac{v}{2l}\ (snaarinstrumenten) \\ Gesloten\ buis: f_n = (2n+1)\frac{v}{2l} \end{array}$$

$$\textbf{\textit{Interferentie}}:$$

$$D = D_1 + D_2 = 2Acos\left(\frac{k\Delta x}{2}\right)\cos\left(\frac{k(x_1 + x_2) - \omega t}{2}\right) \Rightarrow \begin{array}{c} \Delta x = n\lambda\ \ Constructieve\ int. \\ \Delta x = (2n+1)\frac{\lambda}{2}\ destrctieve\ int. \end{array}$$

$$\boldsymbol{Zwevingen:}\ \begin{matrix} D_1(x,t) = Asin(\omega_1 t) \\ D_2(x,t) = Asin(\omega_2 t) \end{matrix}$$

$$\Rightarrow\ D = D_1 + D_2 = 2Acos\left(\frac{1}{2}(\omega_1 - \omega_2)t\right)\sin\left(\frac{1}{2}(\omega_1 + \omega_2)t\right)$$

$$\Rightarrow\ D = \underbrace{2Acos\left(2\pi\left(\frac{f_1 - f_2}{2}\right)t\right)}_{amplitude}\sin\left(2\pi\underbrace{\left(\frac{f_1 + f_2}{2}\right)}_{gem.freq}t\right)$$

$$\boldsymbol{Zwevingsfrequentie}: 2\left(\frac{f_1 - f_2}{2}\right) = f_1 - f_2$$

$\underline{\boldsymbol{Doppler\ effect}:}$

$$Als\ bron\ beweegt: f' = \frac{f}{1 \pm \frac{v_B}{v}}$$

$$Als\ waarnemer\ beweegt: f' = \left(1 \pm \frac{v_W}{v}\right)f$$

$$Als\ allebei\ bewegen: f' = \frac{1 \pm \frac{v_W}{v}}{1 \pm \frac{v_B}{v}}\ f$$

Temperatuur

$$\boldsymbol{Vloeistoftermometers}: T(°C) = \frac{L_t - L_0}{L_{100} - L_0}x100°C$$

$$\boldsymbol{Thermische\ expansie}: \begin{matrix} \Delta l = \alpha\ l_0\Delta T \\ \Delta V = \beta\ V_0\Delta T \end{matrix} \Rightarrow \beta = 3\alpha$$

$$\boldsymbol{Ideale\ Gaswet}: \begin{matrix} PV = NkT \\ PV = nRT \end{matrix}$$

Kinetische Gastheorie

$$\overline{K} = \frac{1}{2}m\overline{v^2} = \frac{3}{2}kT$$

$$E_{int} = \frac{3}{2}NkT = \frac{3}{2}nRT$$

$$C_V = \frac{1}{n}\left(\frac{\partial E_{int}}{\partial T}\right)_V$$

$$\boldsymbol{Van\ der\ Waals}: P = \frac{nRT}{V - nb} - a\frac{n^2}{V^2} \Rightarrow \left(P + a\frac{n^2}{V^2}\right)(V - nb) = nRT$$

$$\boldsymbol{Diffusie\ wet\ van\ Flick}: \vec{J} = -D\nabla C$$