FORMULARIO ONDE E OSCILLAZIONI

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1 Molla

- Equazione del moto
  $\ddot{x} + 2\gamma\dot{x} + \omega_0^2 x = 0$

  Legge oraria
  $x(t) = -x_0 + A_0 e^{-\gamma t} cos(\omega t + \phi)$

- $\omega = \sqrt{\omega_0^2 - \gamma^2} = \frac{2\pi}{T} = \sqrt{\frac{k}{m}}$ $\quad \gamma = \frac{1}{t*} ln\left(\frac{A_0}{A_{t*}}\right)$ $\quad tan(\phi) = -\frac{v_0}{x_0\omega} - \frac{\gamma}{\omega}$

2 Lenti, diottri e specchi

- DIOTTRO

  $\frac{n_1}{p} + \frac{n_2}{q} = \frac{n_2 - n_1}{R}$ $\quad m = \frac{h'}{h} = -\frac{q}{p} \cdot \frac{n_1}{n_2}$ $\quad f_{p\to\infty} = q = \frac{n_2 R}{n_2 - n_1}$ $\quad f_{q\to\infty} = p = \frac{n_1 R}{n_2 - n_1}$

- LENTI

  $\frac{1}{p} + \frac{1}{q} = \frac{n_2 - n_1}{n_1}\left(\frac{1}{R_1} - \frac{1}{r_2}\right)$ con $\supset_{R<0}$ $\subset_{R>0}$ $\quad m = \frac{h'}{h} = -\frac{q}{p}$

- SPECCHIO

  $m = \frac{h'}{h} = -\frac{f}{f-p} = \frac{f-q}{f}$

3 Corda

- BASI

  $v = \frac{\sqrt{T_0}}{\rho}$ $\quad v = \lambda\,\nu$ $\quad \omega = k\,v$ $\quad \lambda_n = \frac{4L}{n}$ $(n\ dispari)$ Un estremo libero $\quad \lambda_n = \frac{2L}{n}$ $(n\ \ pari)$ Estremi vincolati

- CONTINUITÁ, CONSERVAZIONE ENERGIA

  $p = \frac{1}{2} T_0 A^2 k\,\omega \qquad (k\,\omega = k^2 v = \frac{\omega^2}{v})$ $\quad A_i + A_r = A_t$

  $r = \frac{A_r}{A_i}$ $\quad t = \frac{A_t}{A_i}$ $\quad R = \frac{P_r}{P_i}$ $\quad T = \frac{P_t}{P_i}$ $\quad R + T = 1$, $r + 1 = t$

  $r = \frac{k_1 - k_2}{k_1 + k_2}$ $\quad t = \frac{2k_1}{k_1 + k_2}$ $\quad R = r^2$ $\quad T = \frac{4k_1}{(k_1 + k_2)^2}$ $\Rightarrow (k_1, k_2) \leftrightarrow (\sqrt{\rho_1}, \sqrt{\rho_2}) \leftrightarrow (n_1, n_2)$

  $\Psi_r = A_r cos(\omega\,t + k\,z) \quad \longleftarrow$
  $\Psi_t = A_t cos(\omega\,t - k\,z) \quad \longrightarrow$

4 Rifrazione

- SNELL

  $n_1 sin\theta_i = n_2 sin\theta_t$ $\quad sin\theta_{lim} = \frac{n_1}{n_2} \quad (n_1 < n_2)$

- ATTENUAZIONE ANTIRIFLESSO

  $R = \frac{P_r}{P_i} = r_1^2 + r_2^2 + 2 r_1 r_2 cos(\frac{4\pi n_2 a}{\lambda})$ con $r_1 = \left(\frac{n_1 - n_2}{n_1 + n_2}\right)$ e $r_2 = \left(\frac{n_2 - n_3}{n_2 + n_3}\right)$

  n_1 $(aria)$
  n_2 $(antiriflesso)$
  n_3 $(vetro)$

5 Acustica

- $I = \frac{\mathcal{P}}{\Sigma r^2}$ $I_{(r)} = I_{(r_0)} \cdot \frac{r_0^2}{r^2} \cdot e^{-|\alpha|(r-r_0)}$ $\Delta P = \sqrt{2I\rho_o v_s}$ $B = 10\, log_{10}(I) + 120$
- SOGLIE
  $10^{-12}\frac{W}{m^2} \leq I \leq 1\frac{W}{m^2}$ $22\, Hz \leq \nu \leq 20\, kHz$
- DOPPLER
  $\nu_B = \frac{v_s \pm v_B}{v_s \mp v_A} \cdot \nu_A$

6 Reticolo

- $450\, nm \leq \lambda \leq 750\, nm$ $\begin{array}{l} a\, sin\theta = n\lambda \\ d\, sin\theta = m\lambda \end{array}$ $\frac{m}{n} = \frac{d}{a}$ $\begin{array}{l} I_{(\theta)} = 4\, I_0\, cos^2(\delta)\, sinc^2(\alpha) \\ \left(\delta = \frac{kd}{2} sin\theta\right) \\ \left(\alpha = \frac{ka}{2} sin\theta\right) \end{array}$
- $\Delta\theta_{larghezza} = \frac{\lambda}{L\, cos\theta}$ $\Delta\theta_{distanza} = \frac{n\,\Delta\lambda}{d\, cos\theta}$ $R = \frac{\lambda}{\Delta\lambda} = n \cdot N$