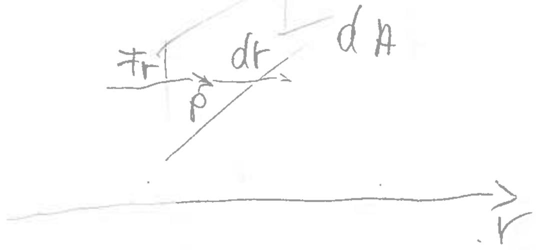
2. Hangintenzitás mérése

Hangintenzitás = felületegységen áthaladó teljesítmény



$$I_{pill.} = \frac{dE}{dt\,dA} = \frac{F_r\,dr}{dt\,dA} = \frac{p\,\cancel{dA}\,dr}{dt\,\cancel{dA}} = p\,v_r$$

$$\tilde{I}_r = \widetilde{p\,v_r}$$

$$p = p_0 \cos \omega t \qquad v_r = v_{0r} \cos(\omega t + \varphi)$$

$$\tilde{I}_r = \frac{1}{T}\int_0^T p_0 v_{0r} \cos \omega t \cdot \cos(\omega t + \varphi)\, dt =$$

$$= \frac{1}{T}\int_0^T p_0 v_{0r} \frac{1}{2}\left(\cos(2\omega t + \varphi) + \cos\varphi\right) dt =$$

$$= \frac{1}{2} p_0 v_{0r} \cos\varphi$$

Komplex jelölésmóddal:

$$p = p_0 e^{j(\omega t + \varphi_1)}$$

$$v_r = v_{0r} e^{j(\omega t + \varphi_2)}$$

$$\tilde{I}_r = \frac{1}{2} Re\{p v^*\} = \frac{1}{2} Re\left\{p_0 e^{j(\omega t + \varphi_1)} \left(v_{0r} e^{j(\omega t + \varphi_2)}\right)^*\right\}$$

$$= \frac{1}{2} Re\left\{p_0 v_{0r} \cancel{e^{j\omega t}} e^{j\varphi_1} \cdot \cancel{e^{-j\omega t}} e^{-j\varphi_2}\right\}$$

$$= \frac{1}{2} Re\left\{p_0 v_{0r} e^{j(\varphi_1 - \varphi_2)}\right\} = \frac{1}{2} p_0 v_{0r} \cos(\varphi_1 - \varphi_2)$$