Lecture notes

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Repition

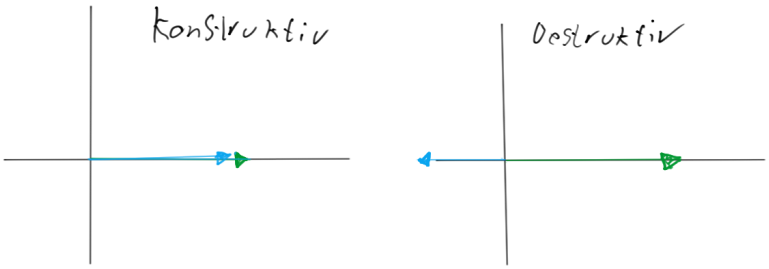
1. Fasprång π vid reflektion mot ett medium där v minskar
2. Intensitet $\sim (amplitud)^2$
3. $V_{fas} = \sqrt{\frac{T}{\mu}}$

Inteferens

$$y_1 = A\sin(kx - \omega t),\ y_2 = A\sin(kx - \omega t + \phi)$$
$$y_{tot} = y_1 + y_2 = 2A\cos\left(\frac{\phi}{2}\right)\sin\left(kx - \omega t + \frac{\phi}{2}\right)$$

Formel för addition av sinus funtioner:

$$\sin\alpha + \sin\beta = 2\cos(\frac{\alpha - \beta}{2})\sin\left(\frac{\alpha + \beta}{2}\right)$$



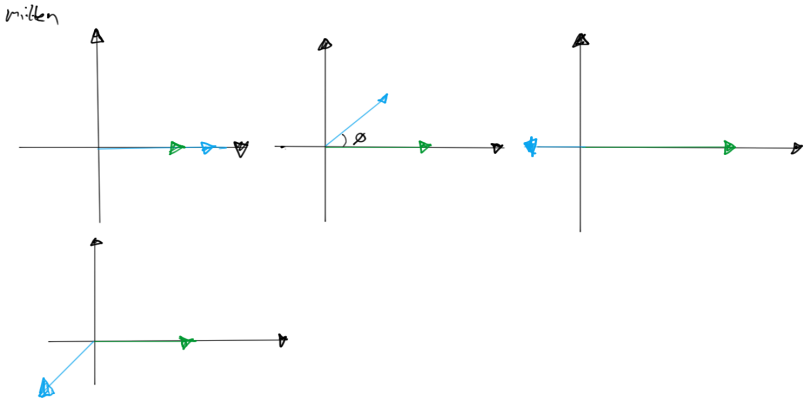
Extrem fall:

Konstruktiv inteferens:

$$\cos(\frac{\phi}{2}) = \pm 1 \rightarrow \frac{\phi}{2} = m\pi \rightarrow \phi = m2\pi$$

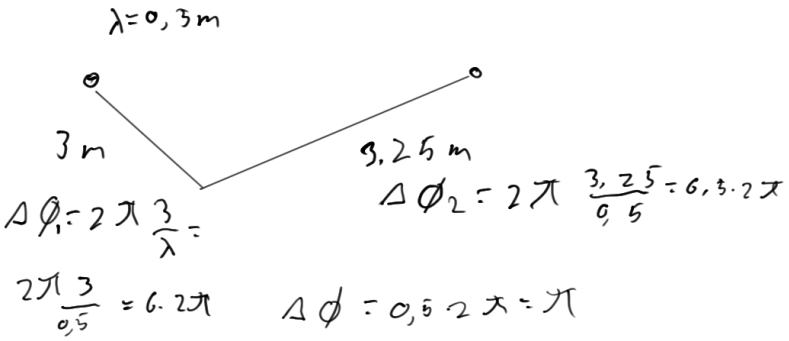
Destruktiv inteferens:

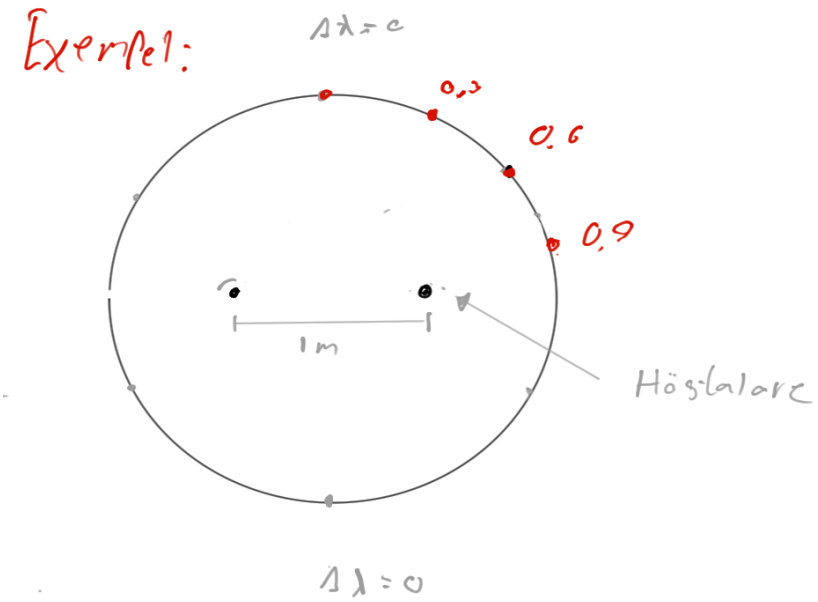
$$\cos(\frac{\phi}{2}) = 0 \rightarrow \frac{\phi}{2} = (2m+1)\frac{\pi}{2}$$

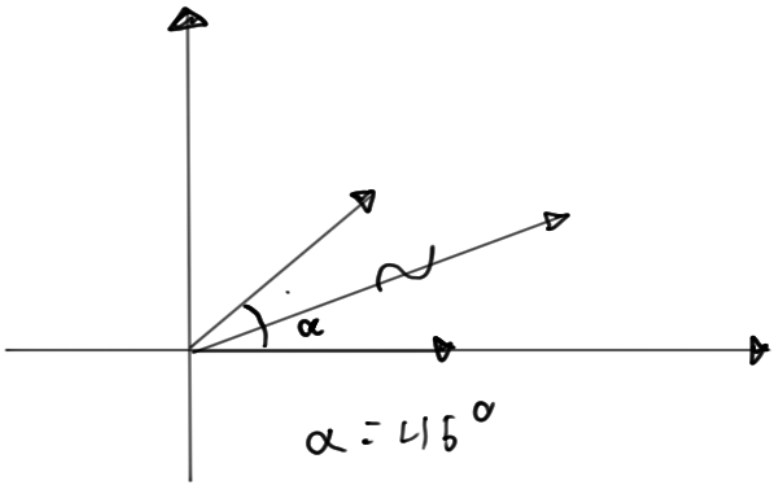


Promenad mellan två högtalare.

Exempel







Max intensitet

$$y_{tot} = 2A\cos\frac{\phi}{2}\sin\left(kx - \omega t + \frac{\phi}{2}\right)$$

Max intensitet:

$$I = I_{max} * \cos^2\left(\frac{45}{2}\right), I_{max} \sim 4A^2$$

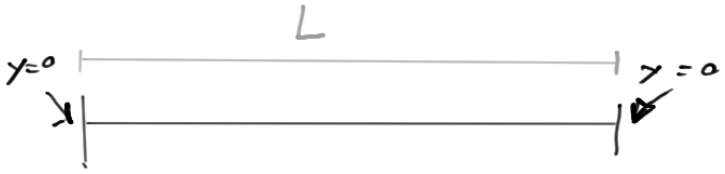
Stående vågor

$$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$$

$y_1 = A\sin(kx - \omega t),, y_2 = A\sin(kx + \omega t)$

$y_{tot} = y_1 + y_2 = A(\sin kx\cos\omega t - \cos kx\sin\omega t + \sin kx\cos\omega t + \cos kx\sin\omega t) =$

$= 2A\sin kx\cos\omega t$

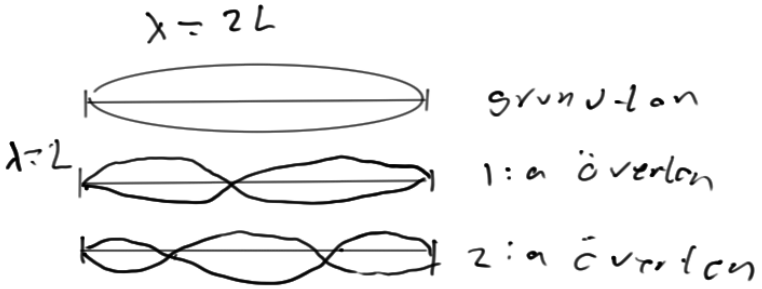


Stående våg på sträng

Krav: $\sin kL = 0 \rightarrow kl = m\pi$

$$k = m\frac{\pi}{L}\ \lambda = \frac{2\pi}{k} = \frac{2L}{m}$$

$$k = \frac{2\pi}{\lambda}$$



$$v = f \cdot \lambda, v = \sqrt{\frac{T}{\mu}}$$

$$\rightarrow f * \frac{2L}{m} \rightarrow f = \frac{m\sqrt{\frac{T}{\mu}}}{2L}$$

Svävningar (Beats)

$$\cos\alpha + \cos\beta = 2\cos\frac{\alpha-\beta}{2}\cos\frac{\alpha+\beta}{2}$$

$y_1 = A\cos(k_1 x - \omega_1 t),\ y_2 = A\cos(k_2 x - \omega_2 t)$

$x = 0$

$y_1 = A\cos(\omega_1 t),\ y_2 = A\cos(\omega_2 t)$

$\omega = 2\pi f$

$$y = y_1 + y_2 = 2A\cos\left[2\pi\left(\frac{f_1 - f_2}{2}\right)t\right]\cos\left[2\pi\left(\frac{f_1 + f_2}{2}\right)t\right]$$