Lecture notes

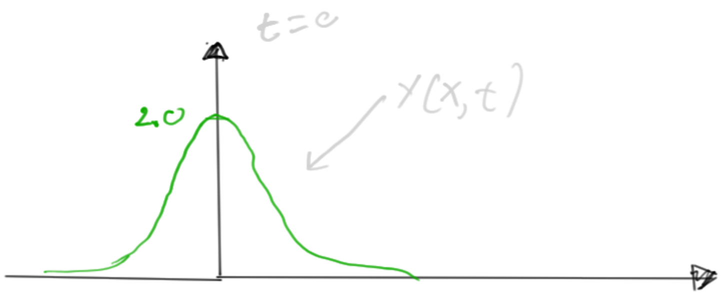
Lukas Rahmn

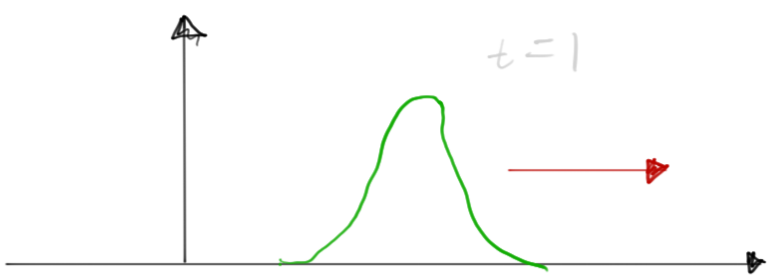
Mekaniska och Elektromagnetiska vågor.

Transversell våg, störning vinkelrät mot utbredningen. Longitudinell våg: störn parralell med utbredningen.

Transversell våg

$$y(x,t) = \frac{2.0}{(x-3.0t)^2+1}$$

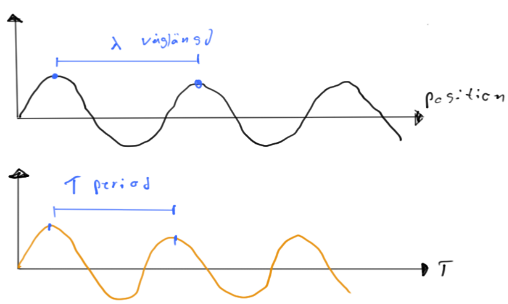




Våg:

$$y(x,t) = f(x - vt) \text{ Utbredning } \leftarrow$$
$$y(x,t) = f(x + vt) \text{ Utbredning } \rightarrow$$

Harmoniska vågor



$$t = 0,\ y = A\sin ax,\ \sin(ax) = \sin\left[a(x+\lambda)\right] \to$$

$$a(x+\lambda) = ax + 2\pi \to ax + a\lambda = ax + 2\pi \to a = \frac{2\pi}{\lambda} = k$$

Tid:

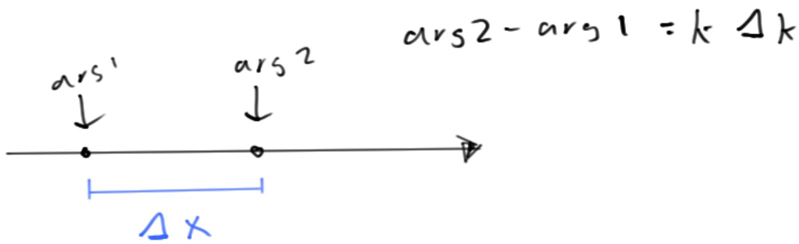
$$y(x,t) = A\sin\left[\frac{2\pi}{\lambda}(x - vt)\right] = A\sin\left[\frac{2\pi}{\lambda}(x - f\lambda t)\right] =$$

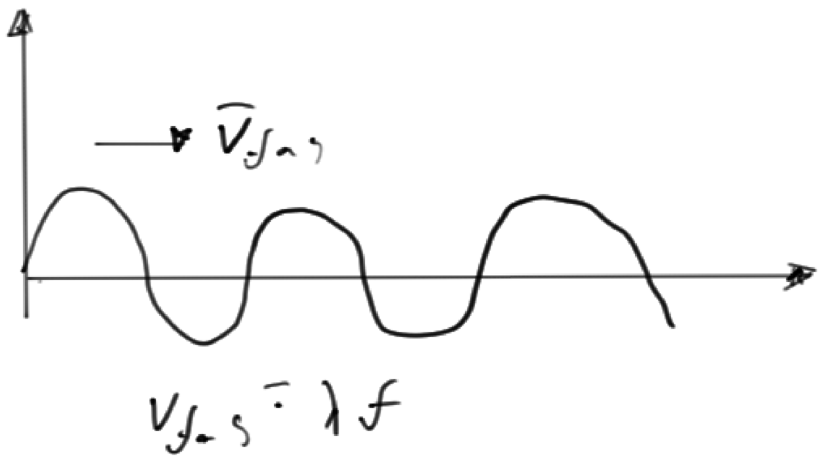
$$= A\sin\left[\frac{2\pi}{\lambda}x - 2\pi f t\right] = A\sin(kx - \omega t)$$

$v * t = \lambda$ och $f = \frac{1}{T} \to v = \lambda f$

$$\text{Alla samma: } \begin{cases} y(x,t) = A\sin(kx - \omega t) \\ y(x,t) = -A\sin(kx - \omega t) \\ y(x,t) = A\cos(kx - \omega t) \\ y(x,t) = A\sin(\omega t - kx) \end{cases}$$

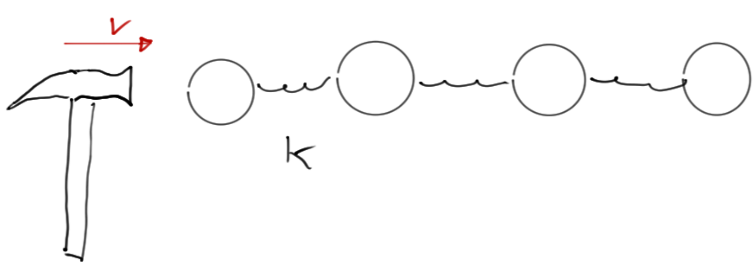
Allmänt $y(x,t) = A\sin(kx - \omega t + \Phi)$

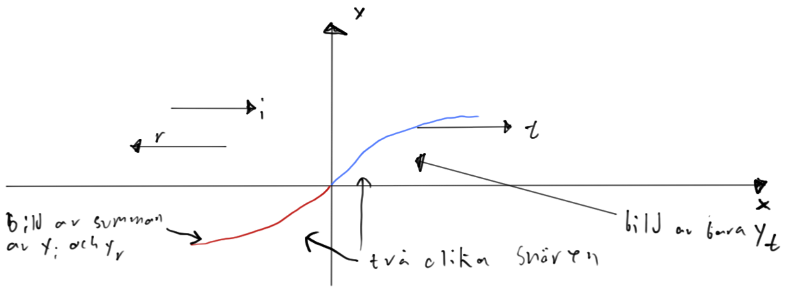




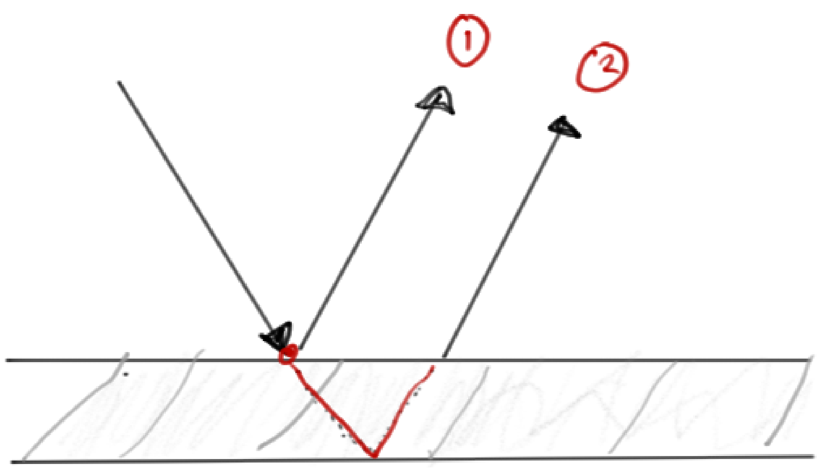
$$y(x,t) = A\sin(kx - \omega t)$$
$$\text{Partikelhastighet: } \frac{dy}{dt} = -\omega A\cos(kx - \omega t)$$
$$\text{Partikelacceleration: } \frac{d^2y}{dt^2} = \omega^2 A\sin(kx - \omega t)$$

Fashastigheten





$$y_i = A_i \sin\left[\omega(t - \frac{x}{v_1})\right]$$
$$y_t = A_t \sin\left[\omega(t - \frac{x}{v_2})\right]$$
$$y_r = A_r \sin\left[\omega(t + \frac{x}{v_2})\right]$$
$$x = 0: \ y_i + y_r = y_t \rightarrow A_i \sin\omega t + A_r \sin\omega t = A_t \sin\omega t \rightarrow A_i + A_r = A_t$$
$$x = 0: \ \frac{d}{dx}(y_i + y_r) = \frac{d}{dx} y_t \rightarrow \frac{1}{v_1}(A_i - A_r) = \frac{1}{v_2} A_t$$
$$A_t = \frac{2v_2}{v_2 + v_1} A_i \ A_r = \frac{v_2 - v_1}{v_2 + v_1} A_i$$



Intensitet

$$\frac{\text{effekt}}{m^2}, \ I \sim (\text{amplitud})^2$$