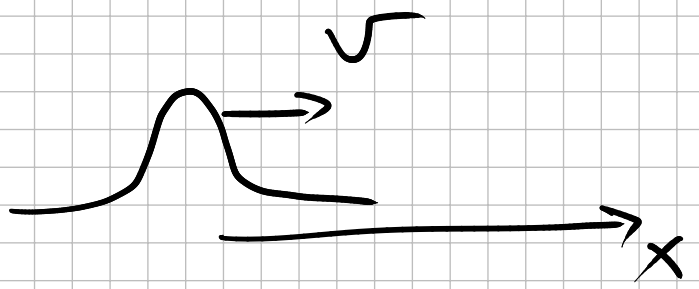
Pulse propagation

$$f(x,t) = f(x - v_x t)$$



$$\frac{\partial^2}{\partial x^2} f(x,t) = f''(u) \qquad u = x - v_x t$$

$$\frac{\partial^2}{\partial t^2} f(x,t) = (-v_x)^2 f''(u)$$

$$\boxed{\frac{\partial^2}{\partial x^2} f(x,t) = \frac{1}{(v_x)^2} \frac{\partial^2}{\partial t^2} f(x,t)}$$

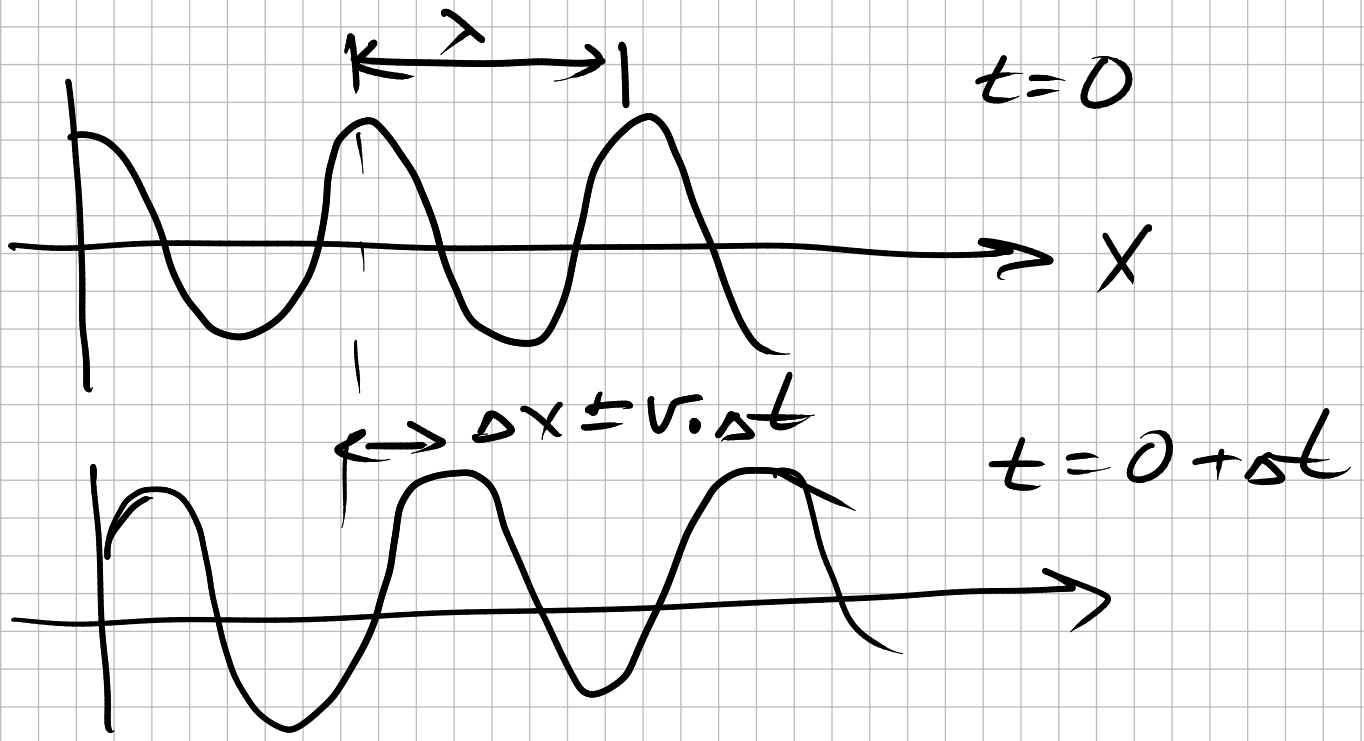
A posible periodic solution

$$f(x,t) = A\cos(kx - \omega t) = A\cos\left(k\underbrace{\left(x - \frac{\omega}{k}t\right)}_{u}\right)$$

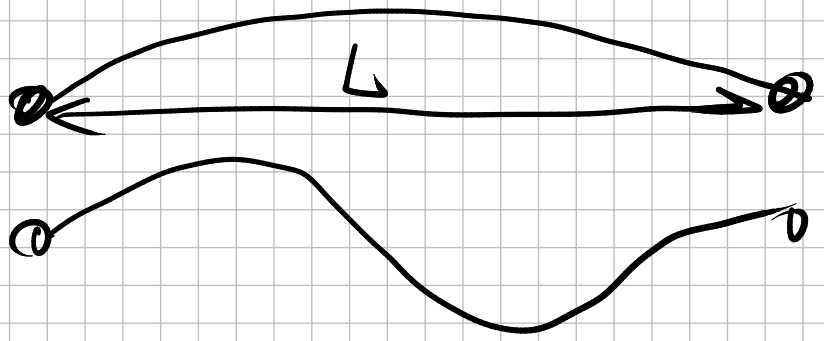
$$\omega = 2\pi f = 2\pi \frac{1}{\text{Period}}$$

k - wave vector

$k = \frac{2\pi}{\lambda}$ ← wave length


λ
t=0
X
Δx=v.Δt
t=0+Δt

String instruments



$$v = \sqrt{\frac{T}{\mu}}$$

Wind instrument

$$v = \sqrt{\frac{\gamma P}{\rho}}$$

But we can change length L