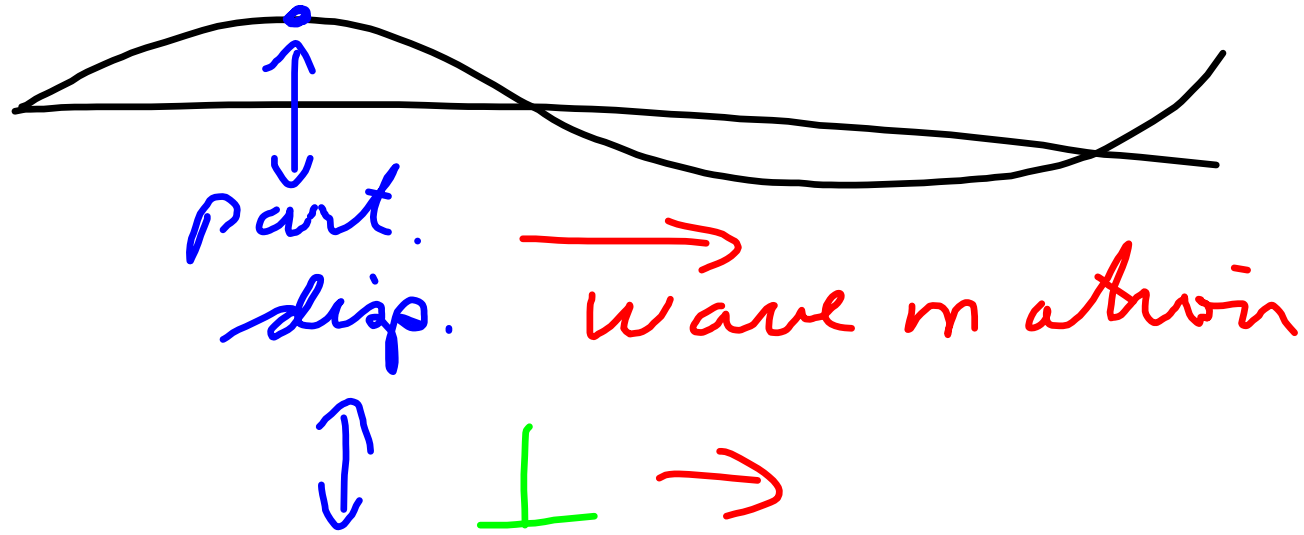


# Waves



1 disturbance

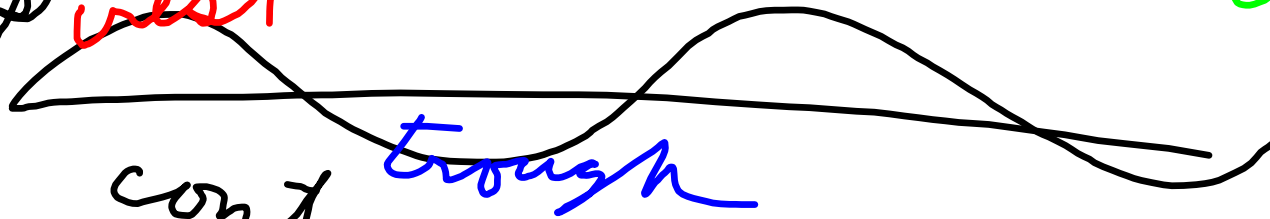
pulse

erect  
" above equil.  
position

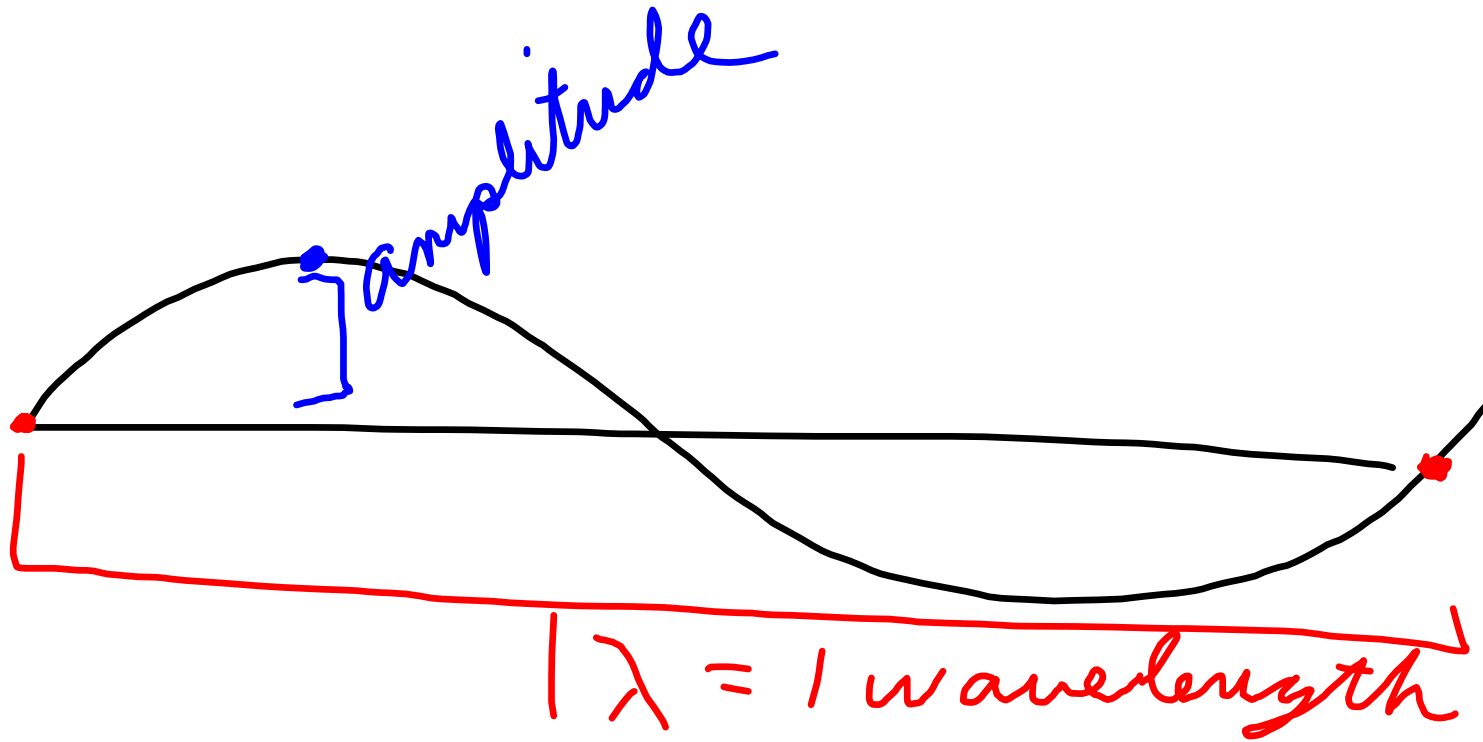


series of disturbances  
crest

inverted



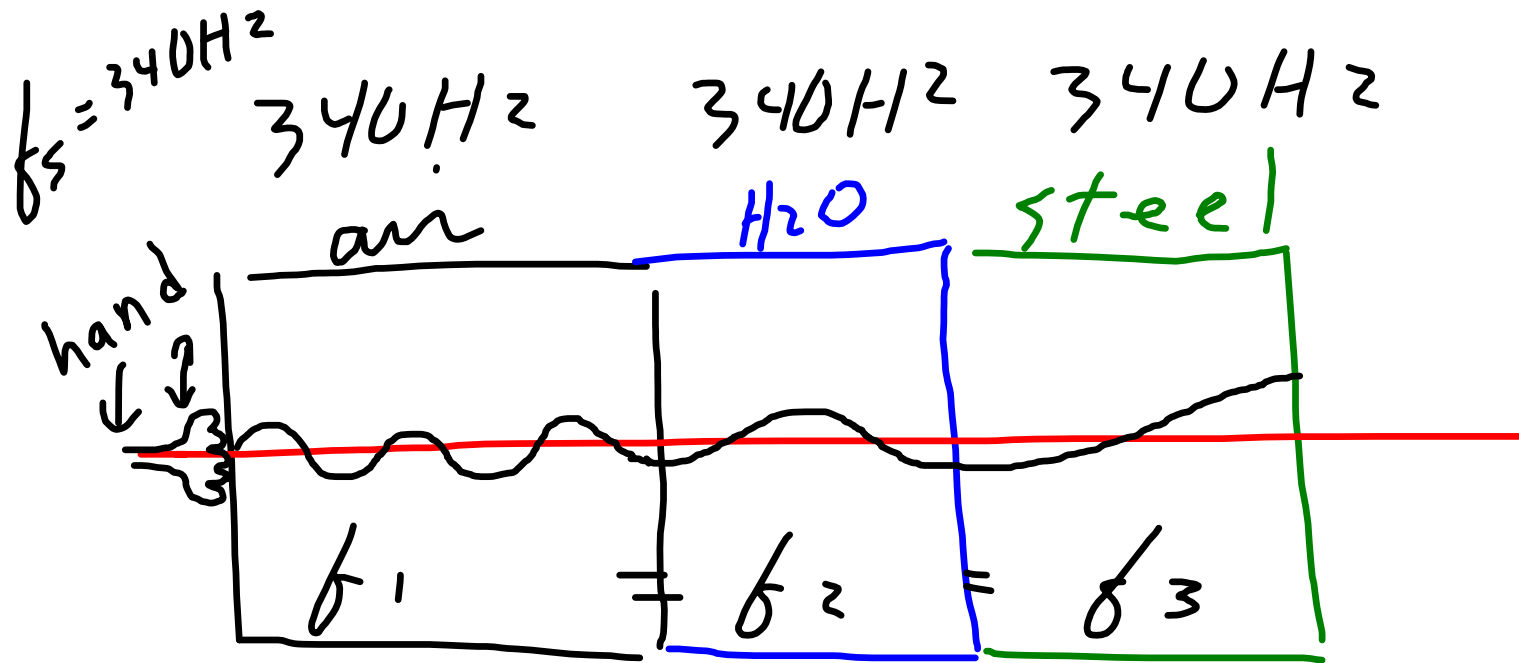
continuous wave  
" wave train "



frequency: # waves/sec.  
Hz (hertz)  $s^{-1}$

\*  $f_s = f_{\text{wave}}$  once a wave  
source of wave is produced  
the frequency  
doesn't change

Even when a wave passes  
from medium to another  
the frequency stays the  
same!



\* frequency stays  
Constant!

$$f_s = f_1 = f_2 = f_3$$

Velocity of a wave :

Determined by the  
characteristics (properties)  
of the medium

all waves have a constant,  
set velocity in a medium

solid

$$v = \sqrt{\frac{E}{\rho}}$$

elastic property of a solid

fluid

$$v = \sqrt{\frac{\beta}{\rho}}$$

Bulk Modulus  
"Elastic prop. of a fluid"

wire string spring

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

tension  
mass/length

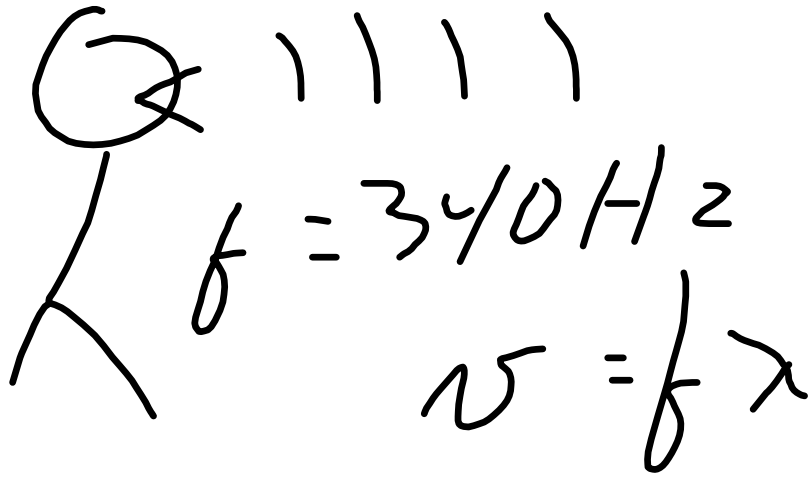
# Sound Velocities

$$v_{\text{air}} = 340 \text{ m/s}$$

$$v_{\text{H}_2\text{O}} = 1500 \text{ m/s}$$

$$v_{\text{steel}} = 5100 \text{ m/s}$$

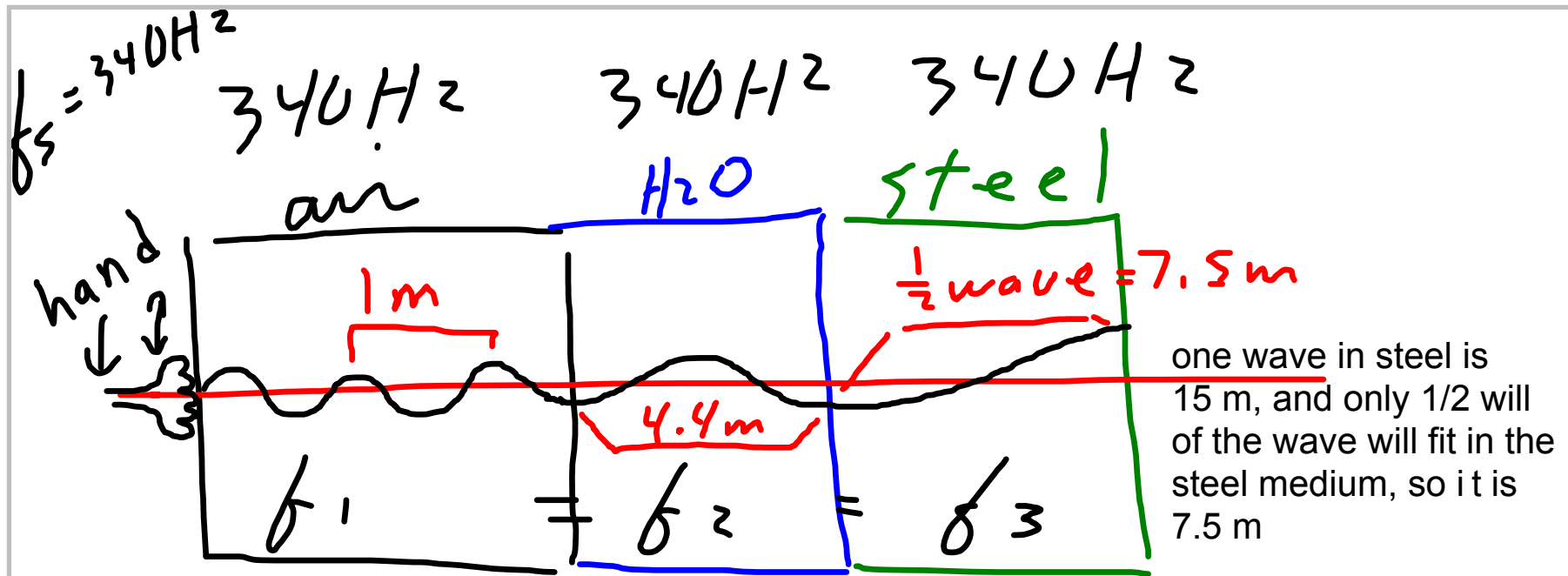




$$\text{in air } \lambda = \frac{v}{f} = \frac{340 \text{ m/s}}{340 \text{ Hz}} = 1 \text{ m}$$

$$\text{in H}_2\text{O } \lambda = \frac{v}{f} = \frac{1500 \text{ m/s}}{340 \text{ Hz}} = 4.4 \text{ m}$$

$$\text{in steel } \lambda = \frac{v}{f} = \frac{5100 \text{ m/s}}{340 \text{ Hz}} = 15 \text{ m}$$



\* frequency stays constant!

$$f_s = f_1 = f_2 = f_3$$