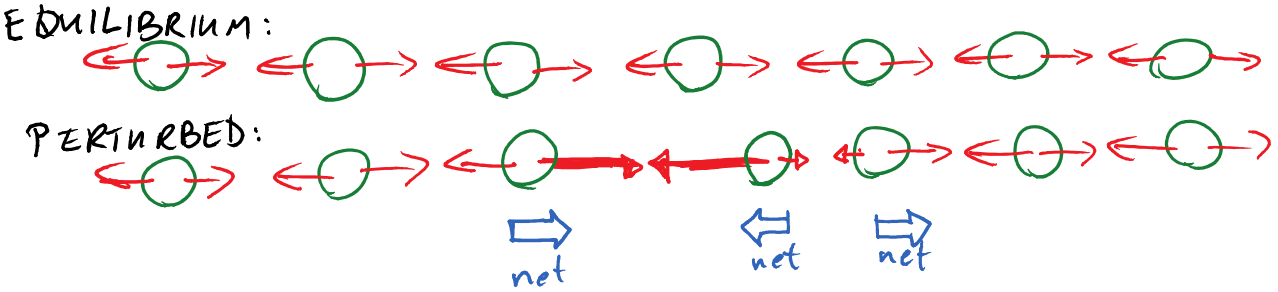
WAVES

→ arise in diverse settings: gases (sound waves), fluids (sound, surface waves), solids (sound waves, surface waves, transverse waves), EM waves, gravity waves, QM waves

→ universal phenomenon when perturbing "continuous" systems from mechanical equilibrium (i.e. all forces balanced)



→ displacement of one part upsets force balance → create forces to restore displaced part + displace nearby parts

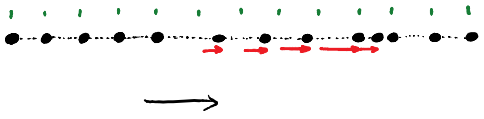
→ disturbance propagates outward, but only finite amount of energy put in, so location of original disturbance settles to original position

→ energy carried away. (no net motion of particles)

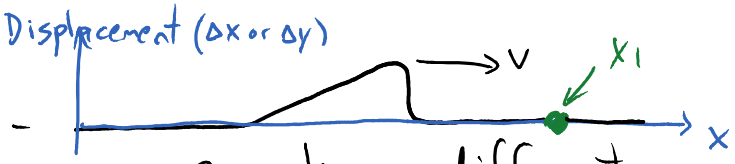
Basic properties of traveling waves:

- Can be TRANSVERSE or LONGITUDINAL

i.e. displacement perp. to velocity



displacement parallel to velocity.

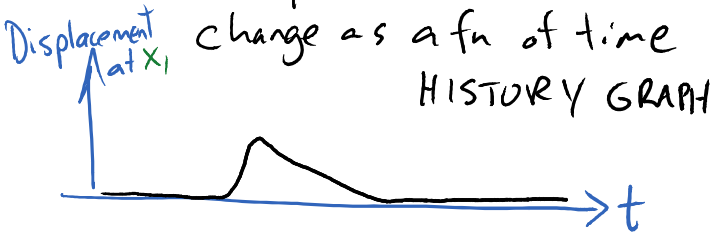


- can have different profile (shape in space) → shown by "SNAPSHOT" graph

represent mathematically by function D(x,t): this gives us a function of x (the shape) for each time t.

alternatively: can talk about time dependence of single point e.g. how does the position of ●— change as a fn of time

HISTORY GRAPH



- Has a velocity (but can spread w. time for real examples)

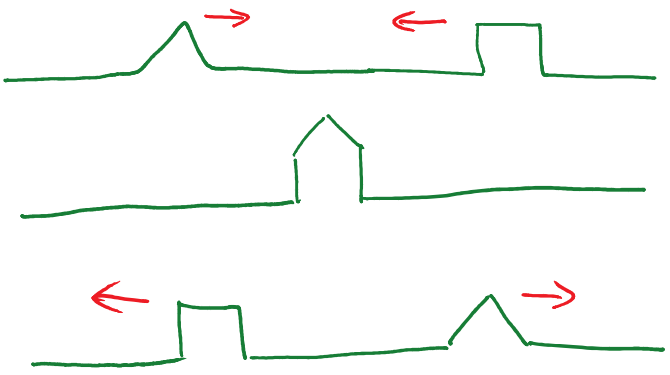
e.g. $F(x) = D(x,0)$: shape of wave pulse at time $t=0$

Right-moving pulse: $D(x,t) = F(x-vt)$

Left-moving pulse: $D(x,t) = F(x+vt)$

Crucial Property:

Superposition principle: If $D_1(x,t)$ and $D_2(x,t)$ are allowed, so is $D_1(x,t) + D_2(x,t)$



pulses just add up when they pass + don't affect each other.