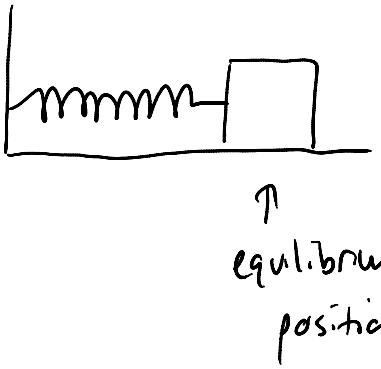
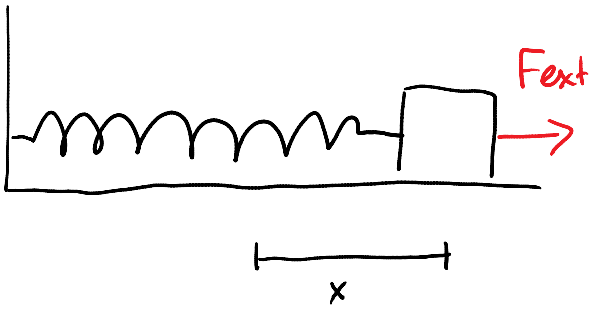
Section 31.10: Applications of Higher-order Equations

Wednesday, April 29, 2015
3:02 PM

Hooke's Law:



consider a mass on a frictionless surface connected to a wall by an ideal spring



pull spring to right by Fext (a constant force)

→ then the spring stretches, and pulls back with

$$\vec{F}_{spring} = -\vec{F}_{ext}$$

but Hooke's Law says:

$$\vec{F}_{spring} = -k\vec{x}$$

↑
if stretch spring to right, force is to left

(opposite direction to the

displacement)

now let go of the block, so $F_{ext} = 0$

block has unbalanced force, so it accelerates

$$\Sigma \vec{F} = m\vec{a}$$

$$-kx = ma$$

$$-kx = m\frac{d^2x}{dt^2}$$ ← 2nd order linear DE

note if want to use a different notation, I will likely forgive you if you use x'' for $\frac{d^2x}{dt^2}$

but the actual practice is that

$$\frac{d^2x}{dt^2} = \ddot{x}$$