Equilibrium and Elasticity

Center of Gravity (cog)

$$x_{cog} = x_{com} = \frac{\sum x_i m_i}{\sum m_i}$$

If g is the same all elements of the object

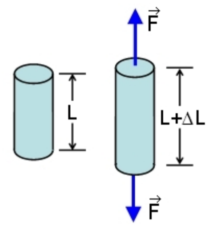
Static Equilibrium

$$F_{net,x} = 0$$
$$F_{net,y} = 0$$
$$\tau_{net,z} = 0$$

We only consider situations in which the forces that acts on the object lie in the x-y plane

Elasticity

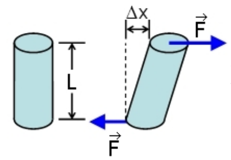
A stress (deforming force per unit area) is applied to produce a strain (unit deformation). There are three ways to change the shape (deform)



Tensile or Compression
Force is applied perpendicular to the area

$$\frac{F}{A} = E \frac{\Delta L}{L}$$

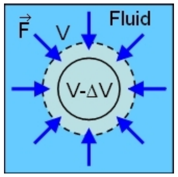
Stress = Young's Modulus × Strain



Shearing
The force lies in the plane of the area

$$\frac{F}{A} = G \frac{\Delta x}{L}$$

Stress = Shear Modulus × Strain



Hydraulic (uniform) compression

$$\frac{F}{A} = B \frac{\Delta V}{V}$$

Stress = Bulk Modulus × Strain

The stress here is the pressure p, and ΔV denotes the absolute value of the change in volume and V is the initial volume
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