

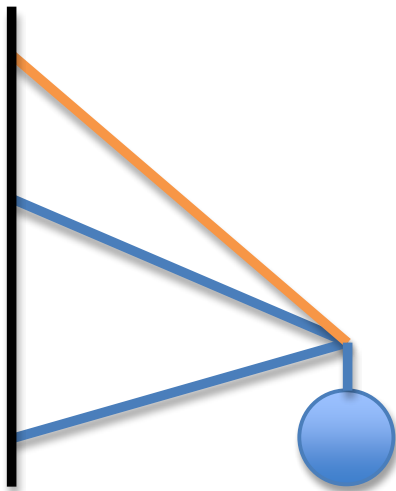
Describe the equilibrium of the frame that supports weight P. Find the force and elongation in each rod. Assume that all rods are made of the same elastic material with elastic constant E and have the same cross section. The hinges can freely rotate.

Describe the equilibrium of the frame without orange rod

Describe the equilibrium of the frame without orange and red rods

Coordinates of the nodes:

$$A=(-1, 2), B=(0, 2), C=(1, 2), D=(1, 1), E=(0, 0).$$



Design a protective damageable structure. It must:

1. Support the weight $P=10$ without damage.
2. Support the weight $P=15$ after the orange link is damaged
3. Has a minimal volume

$$V = \sum S_i L_i$$

here S_i are the cross section areas and L_i are the lengths of the rods.

The neutral nodes positions are:

$$A=(0,3), B=(0, 1), C=(0, -1), D=(2, 0)$$

The cross section areas S_i of the rods are unknown and must be chosen.

The Force vs. Elongation dependence of the rods is $F_i = S_i K_i$, where dependence K_i on elongation is shown below.

