

Statics: Maximum Weight Calculation

Moments about the pivot:

$$W(L\cos\theta) = F_a d_{\perp}$$

$$\Rightarrow W = \frac{F_a d_{\perp}}{L\cos\theta}$$

where d_{\perp} = perpendicular distance from the pivot to the actuator line.

You can calculate d_{\perp} using the 2D cross-product form:

$$d_{\perp} = \frac{|x_A y_B - x_B y_A|}{\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}}$$

For A = (0.90, 0) and B = (0.737, 0.425):

$$d_{\perp} = \frac{|0.90(0.425) - 0(0.737)|}{0.456} = 0.841$$

Therefore, you can get W:

$$W = \frac{(35,810)(0.841)}{1.00\cos\theta} = 34,762 \text{ N}$$

$$m = \frac{W}{g} = \frac{34,762}{9.81} \approx 3,544 \text{ kg}$$