

Hello,

I am trying to figure out what's wrong with a free body diagram I wrote down.

I will represent the problem:

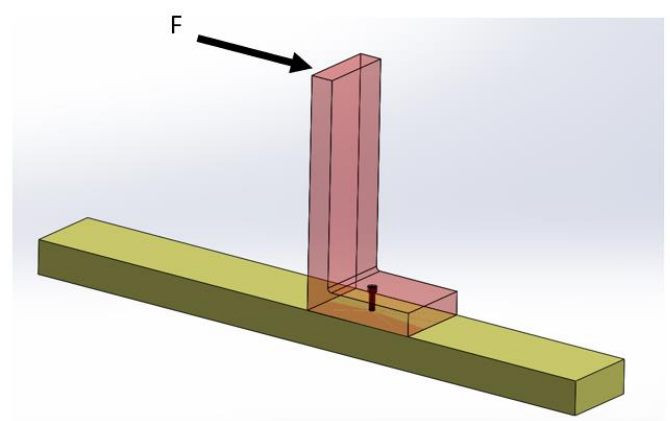
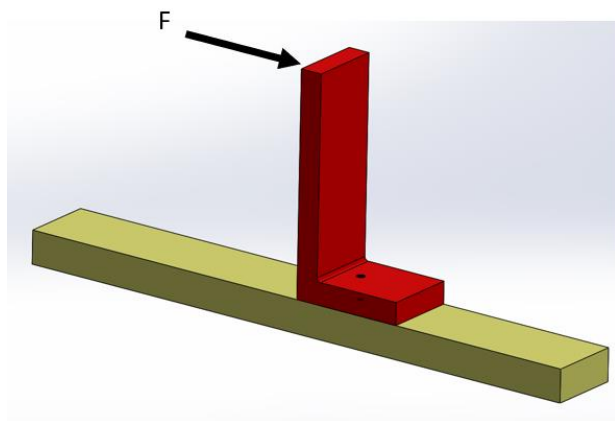
We have a very stiff L profile that is Tightened to the floor with only one bolt.

The aim is finding analytically (and not only intuitively) the best location of the single bolt.

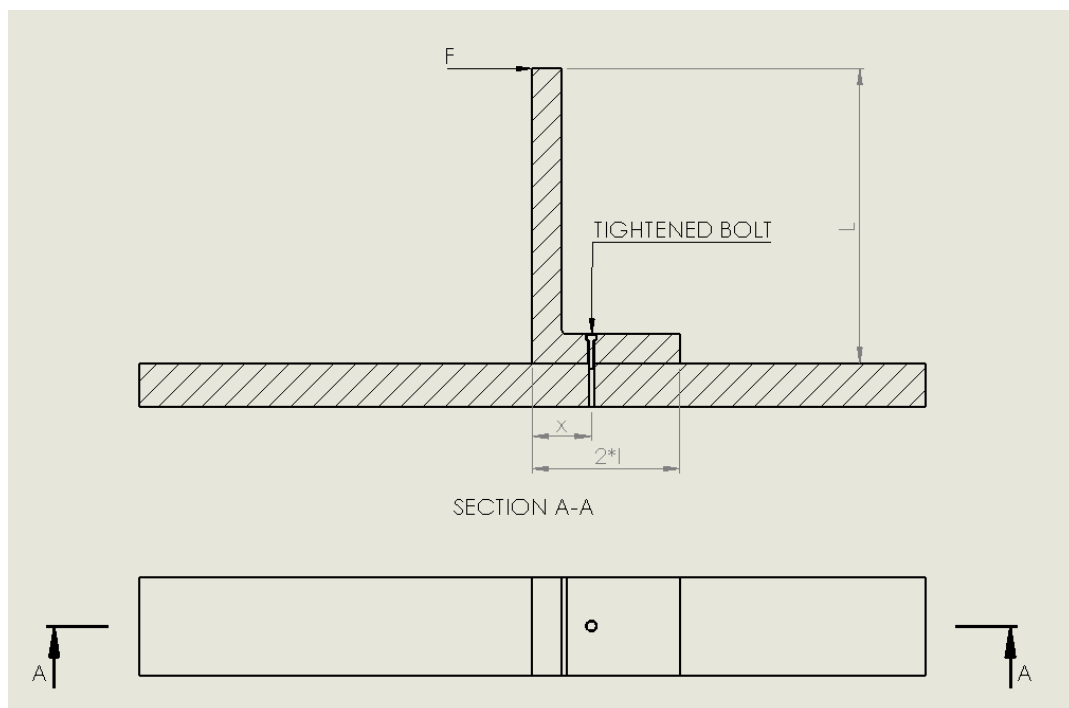
Best location means that we require the bolt the minimum preload.

Actually we have a problem of finding reactions.

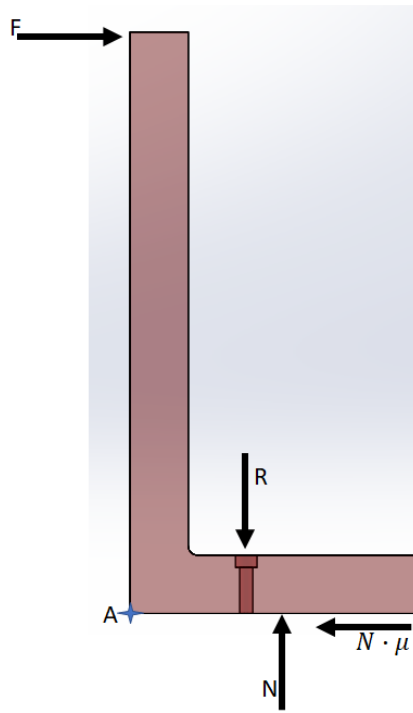
Assumption: the L profile is rigid and no deformation occurs, hence no leaning only on the right edge occurs.



Here are some notations the subsequent equations will use:



Here is a free body diagram:



Here are 3 equilibrium equations:

$$\sum F_X = 0 \rightarrow F - N \cdot \mu = 0 \rightarrow N = \frac{F}{\mu}$$

$$\sum F_Y = 0 \rightarrow -R + N = 0 \rightarrow R = N$$

$$\sum M_{Relative\ to\ A\ point} = 0 \rightarrow -F \cdot L - R \cdot X + N \cdot l = 0 \rightarrow R = \frac{1}{X} \cdot \left(\frac{l}{\mu} - L\right) \cdot F$$

Problems:

1. We see that R is independent of X (when taking in account only the force equilibrium equations).
2. When analyzing the moment equilibrium equation we see unexpected result $R \propto \frac{1}{x}$