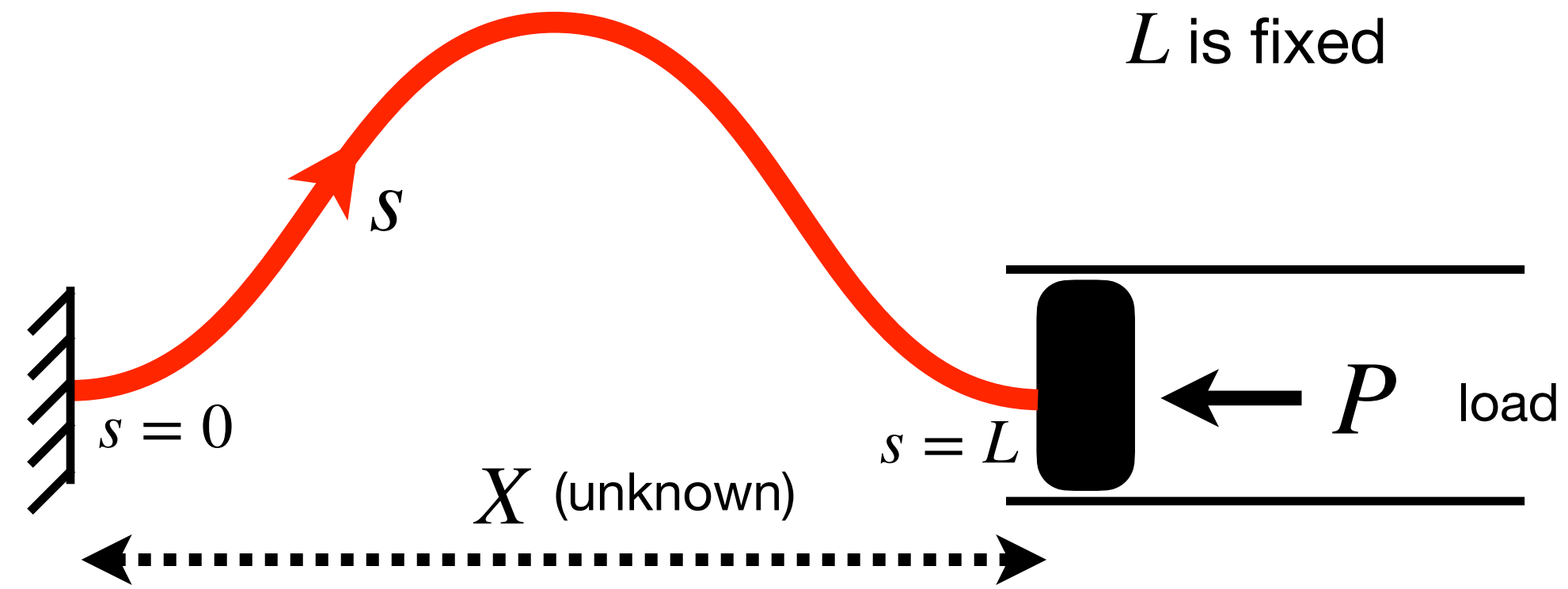


Euler 1744

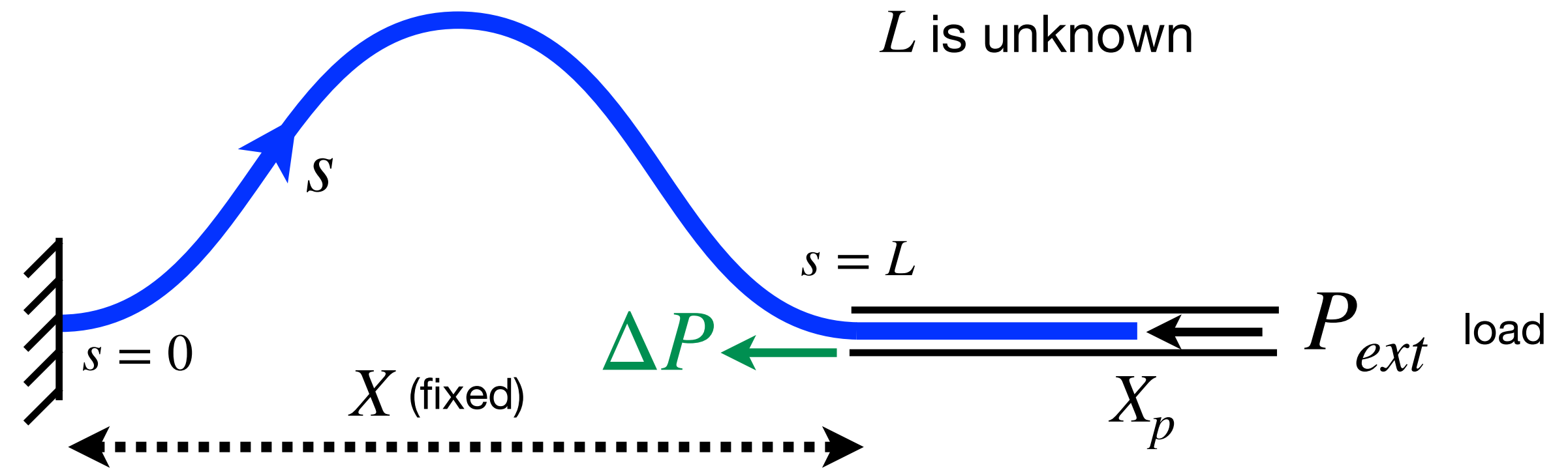
# Planar Elastica



$L$  is fixed

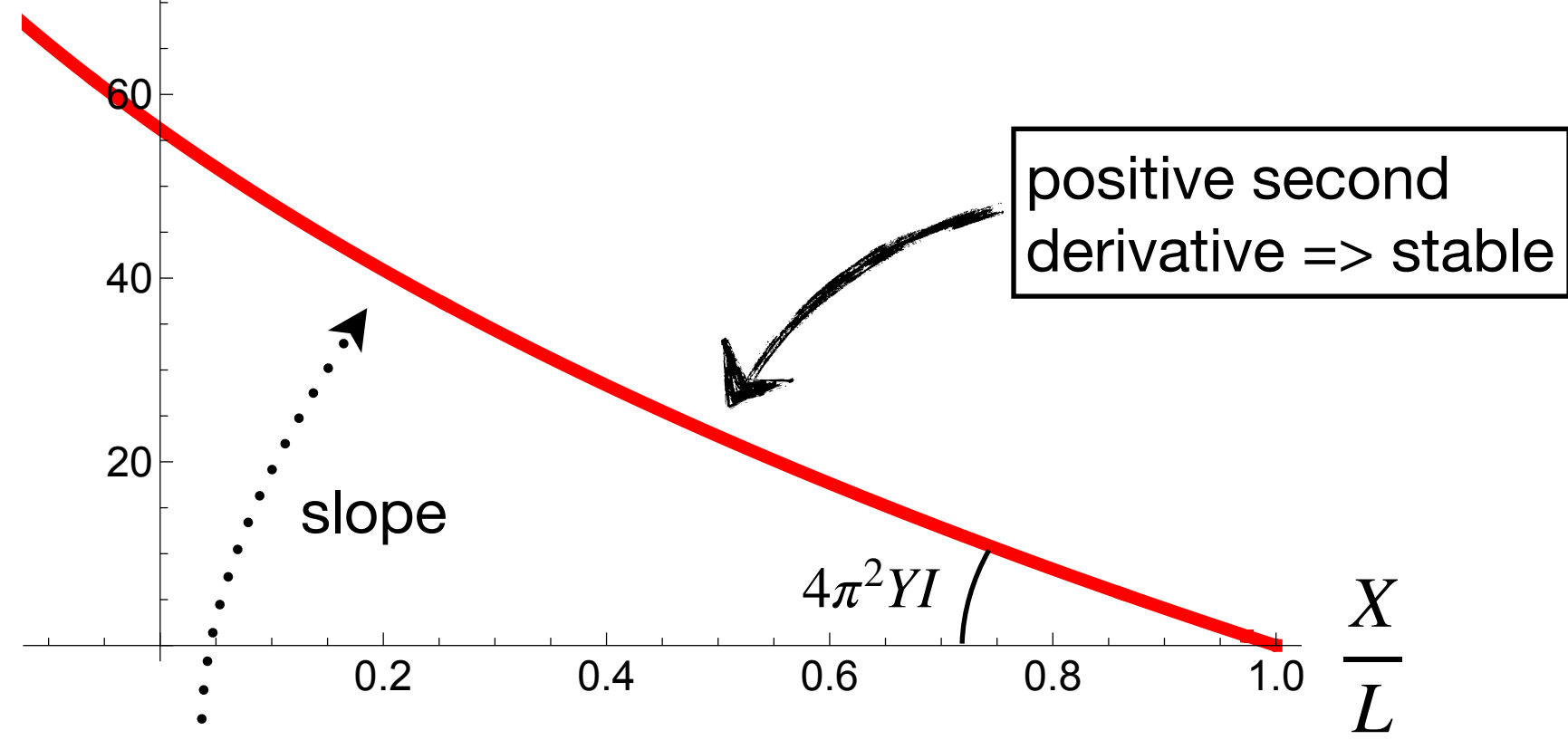
# The (mysterious) sliding sleeve

Bosi (2014) PhD



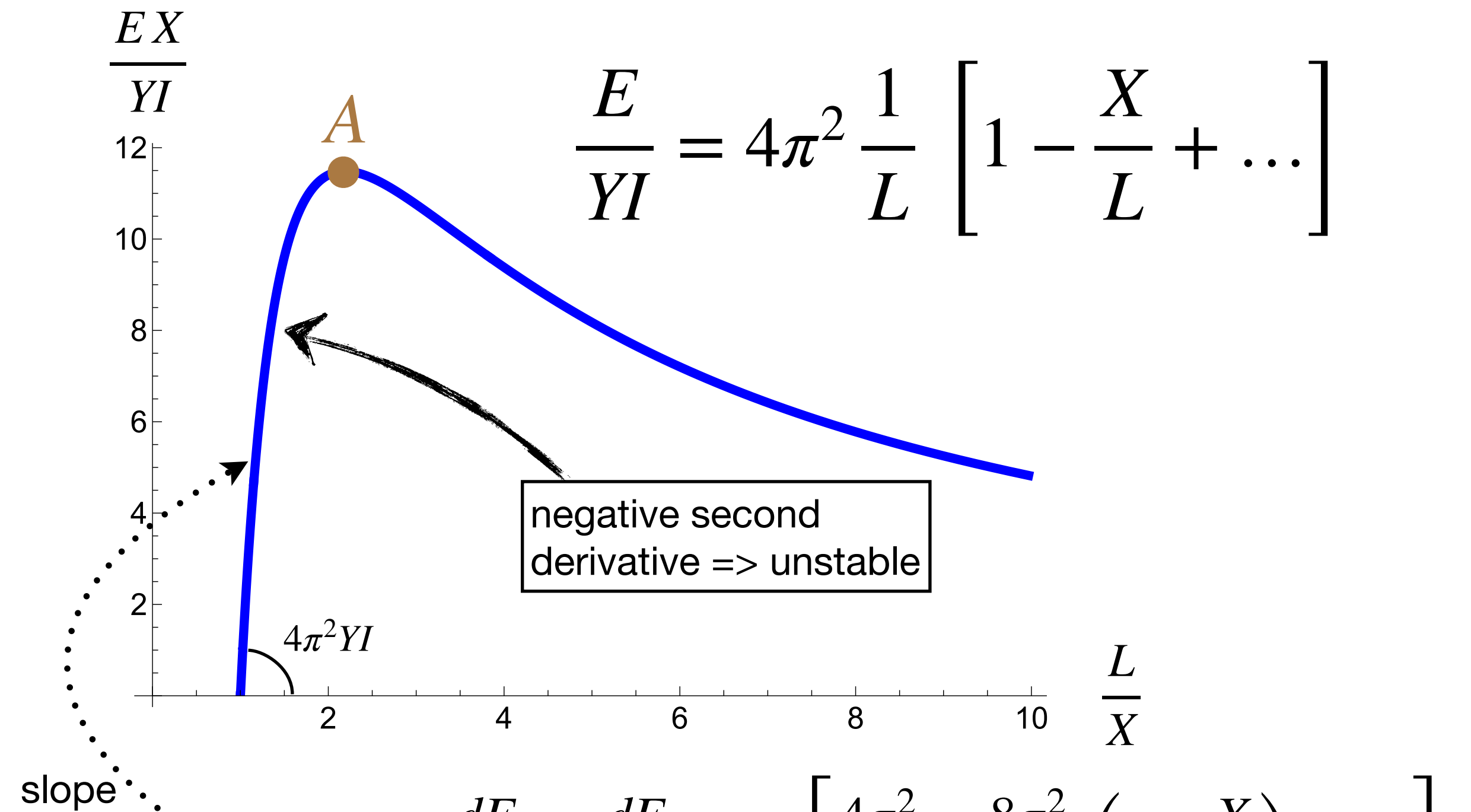
$L$  is unknown

$$\frac{EL}{YI} \quad \frac{E}{YI} = 4\pi^2 \frac{1}{L} \left[ 1 - \frac{X}{L} + \dots \right]$$



$$P = -\frac{dE}{dX} = YI \left[ \frac{4\pi^2}{L^2} + \dots \right]$$

$$\frac{EX}{YI} \quad \frac{E}{YI} = 4\pi^2 \frac{1}{L} \left[ 1 - \frac{X}{L} + \dots \right]$$



$$P_{ext} = -\frac{dE}{dX_p} = \frac{dE}{dL} = YI \left[ \frac{4\pi^2}{L^2} - \frac{8\pi^2}{L^2} \left( 1 - \frac{X}{L} \right) + \dots \right]$$

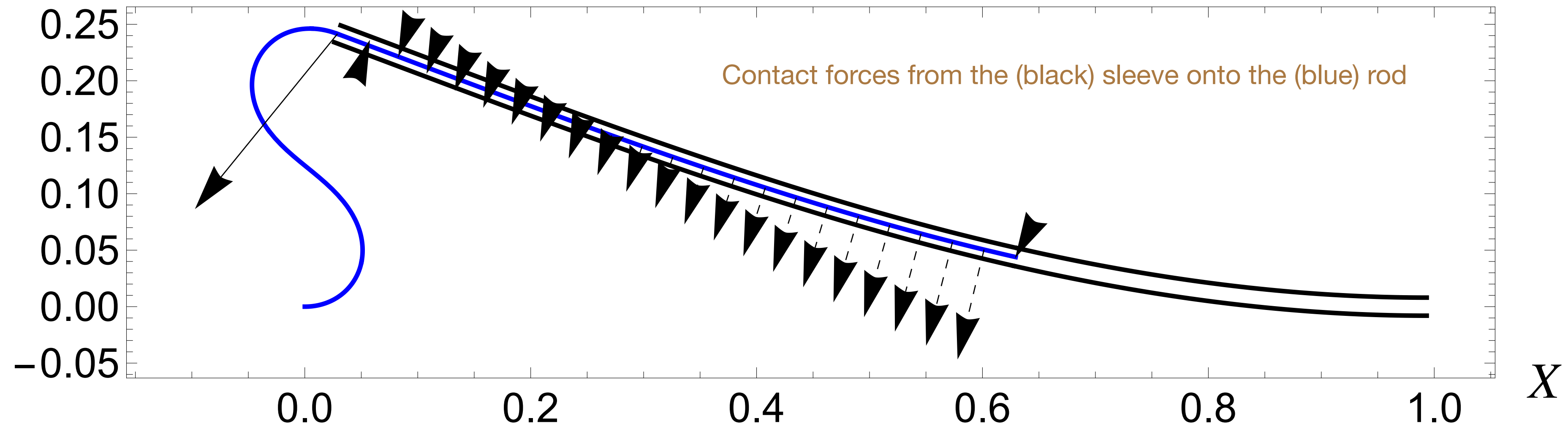
$\Delta P$

NB: At point A, the applied force is zero!

# The flexible sliding sleeve

Neukirch, Dal Corso, Vetyukov 2024

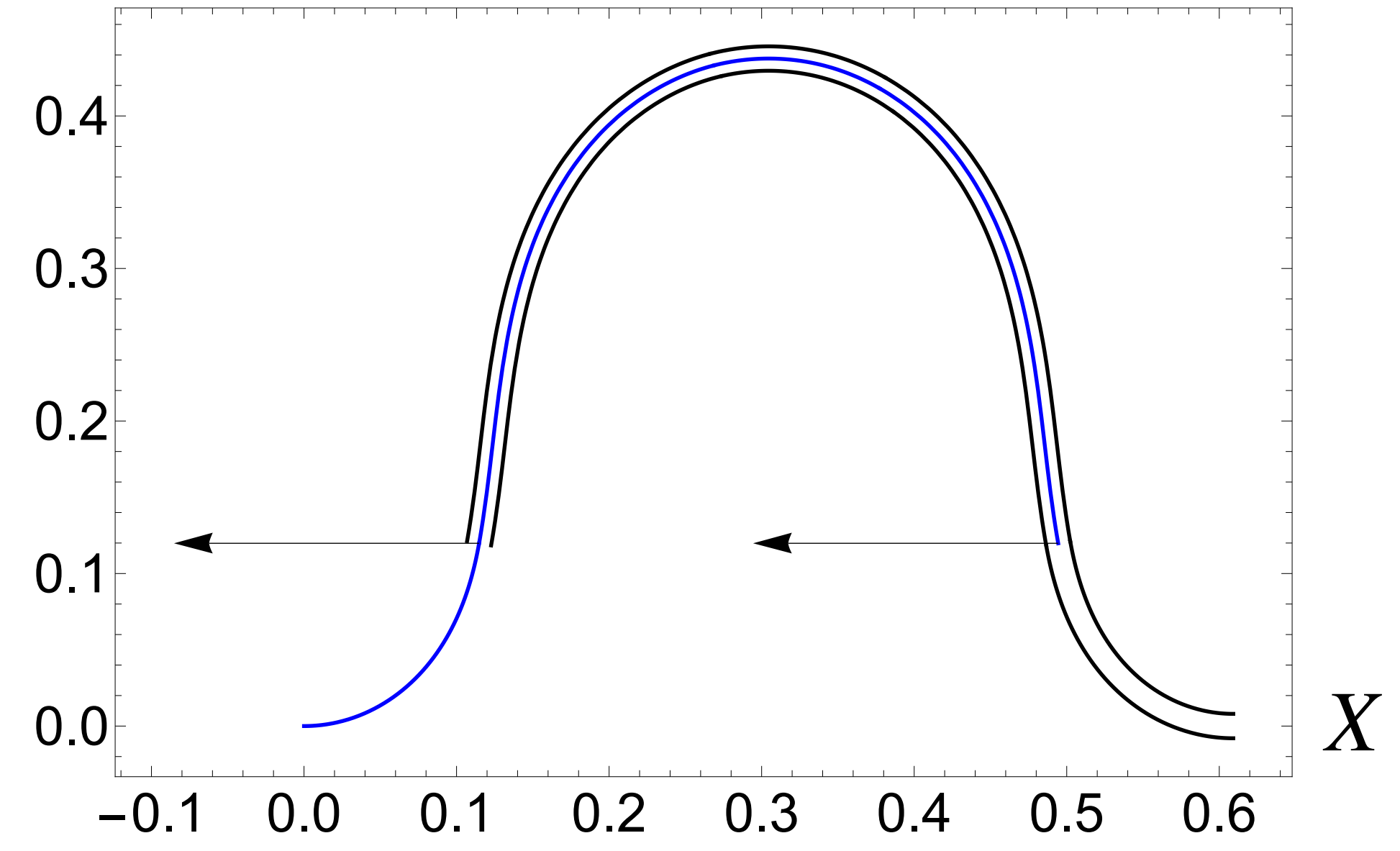
$k = 250.$   $\Delta = 0.503$   $s^* = 0.367$



Blue is 250 times more flexible than black

Contact forces from the (black) sleeve onto the (blue) rod

$k = 1.$   $\Delta = 0.695$   $s^* = 0.181$



Blue and black have same flexibility

No contact forces along the sleeve (!)  
Only point forces at entry/exit points (!)