

55. Let the forces that compress stoppers  $A$  and  $B$  be  $F_A$  and  $F_B$ , respectively. Then equilibrium of torques about the axle requires  $FR = r_A F_A + r_B F_B$ . If the stoppers are compressed by amounts  $|\Delta y_A|$  and  $|\Delta y_B|$  respectively, when the rod rotates a (presumably small) angle  $\theta$  (in radians), then

$$|\Delta y_A| = r_A \theta \quad \text{and} \quad |\Delta y_B| = r_B \theta .$$

Furthermore, if their “spring constants”  $k$  are identical, then  $k = F/\Delta y$  leads to the condition  $F_A/r_A = F_B/r_B$  which provides us with enough information to solve.

- (a) Simultaneous solution of the two conditions leads to

$$F_A = \frac{Rr_A}{r_A^2 + r_B^2} F .$$

- (b) It also yields

$$F_B = \frac{Rr_B}{r_A^2 + r_B^2} F .$$