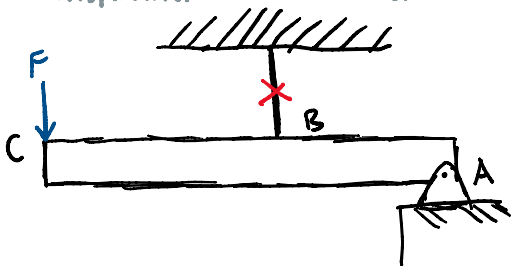
20-R-KIN-DK-24

July 22, 2020 9:35 AM

20-R-KIN-DK-24 Beginner Rotation (RBK) PDF

Inspiration: 17-67 Hibbeler



At the instant the wire at B snaps, determine the reaction forces at A and the angular acceleration of the ***200 kg*** beam if a force of ***600 N*** is applied at point C. Assume the beam is a slender rod.
Point B is located 1/4l away from point A, and the beam has a length ***l = 4 m***.

$$I_A = \frac{1}{12} m l^2 + m d^2 = \frac{1}{12}(200)4^2 + (200)(2^2) = \frac{3200}{3}$$

$$\sum F_x = m a_{Gx} = A_x \qquad a_{Gx} = 0 \Rightarrow \boxed{A_x = 0}$$

$$\sum F_y = m a_{Gy} = A_y - F - mg$$

$$\sum M_A = I_A \alpha = 600(4) + 200(9.81)(2) = \frac{3200}{3}\alpha$$

$$\boxed{\alpha = 5.62875}$$

$$a_G = \vec{a}_A + \vec{\alpha} \times \vec{r}_{G/A} - \omega^2 \vec{r}_{G/A}$$

$$= 0 + \alpha \hat{k} \times (-2\hat{i}) - 0$$

$$= -2\alpha \hat{j} \qquad a_{Gx} = 0 \qquad a_{Gy} = -11.8575$$

$$200(-11.8575) = A_y - 600 - 200(9.81) \qquad \boxed{A_y = 190.5}$$