

86. (Second problem in **Cluster 2**)

This system is extensively discussed in §12-4. Rather than repeat those steps here, we refer to their conclusion, Eq. 12-13.

(a) The magnitude of the result in Eq. 12-13 is

$$|a| = g \frac{1}{1 + \frac{I}{MR^2}} .$$

(b) The relation  $a = a_{\text{com}} = -R\alpha$  used in §12-3 must now be modified to read  $a_f - a_{\text{com}} = R\alpha$  where  $a_f$  is the acceleration of the finger. With this in mind, the linear and angular versions of Newton's second law become

$$\begin{aligned} T - Mg &= Ma_{\text{com}} \\ TR &= I\alpha \quad \text{where } \alpha = \frac{a_f - a_{\text{com}}}{R} \end{aligned}$$

If we require  $a_{\text{com}} = 0$  then these equations yield

$$a_f = g \frac{MR^2}{I} .$$