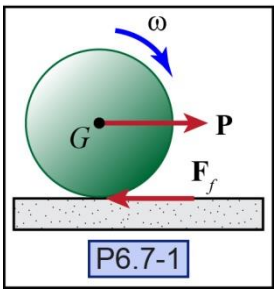
P6.7-1) Consider the 5-kg disk shown rolling to the right under the influence of a pulling force (P = 10 N). Typically when a wheel is rolling on a dry surface without being driven by an external torque, we can neglect slip at the contact surface and the friction force $\mathbf{F}_f$ will resist the disk's motion. Using this fact, estimate the angular acceleration α of the disk as well as the acceleration of its mass center $\mathbf{a}_G$. Assume that the coefficients of friction are μ_s = 0.45 and μ_k = 0.35 and that the wheel has a radius of 1.0 m. Verify that the disk does not slip relative to the ground.

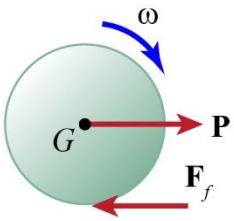


Given:

Find:

Solution:

Free-body diagram



Mass Moment of Inertia

What reference point will be used?

I = _____

Equation of Motion.

Assuming no slip derive the two equations of motion, in variable form, for the disk using Newton's second law and Euler's second law. Then, solve for the static friction force and accelerations.

Newton's Second Law

Eq.M: _____

Euler's Second Law

Eq.M: _____

F_{fs} = _____

α = _____

a_G = 1.33 m/s^2

Check Assumption

Check to see if the no slip assumption is correct.

$F_{fs,max}$ = _____

Is the no slip assumption accurate?

No Yes