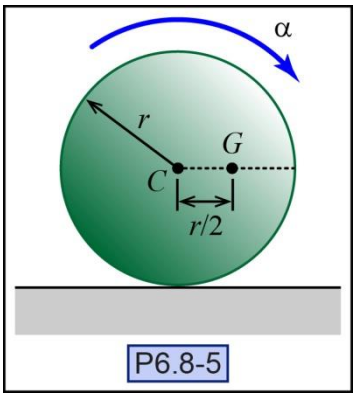
P6.8-5) A 35-lb non-uniform disk of radius 0.5 ft rests on a horizontal surface. The disk is released from rest in the position shown in the figure. If the disk's radius of gyration about its mass center G is 0.2 ft and the coefficient of static and kinetic friction between the disk and surface are 0.4 and 0.2, respectively, determine the angular acceleration at the instant it is released.

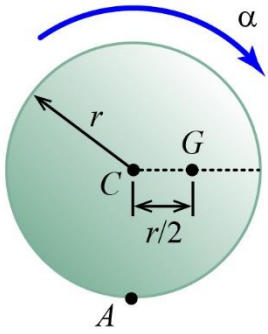


Given:

Find:

Solution:

Draw a free-body diagram of the disk.



Calculate the disk's mass moment of inertia.

Calculate the mass moment with respect to the center of mass.

I_G = _____

Calculate the mass moment with respect to point A.

I_A = _____

Use the disk's equation of motion to solve for the angular acceleration.

To begin with, assume no slip.

α = _____

Verify the no slip assumption.

Calculate the y-component of the mass center linear acceleration assuming no slip.

Hint: If you go from A to G and set the y-component of $\mathbf{a}_A$ equal to zero (which is true for both no slip and slip), it is a more general solution.

$\mathbf{a}_{G,y}$ = _____

Calculate the normal force as a function of the angular acceleration.

$N(\alpha)$ = _____

Calculate the normal force for no slip.

N = _____

Calculate the maximum static friction force for no slip.

$F_{fs,max}$ = _____

Solve for the static friction force for no slip.

F_{fs} = _____

Does the disk slip?

Yes No

Why?

Use the disk's equation of motion to calculate the angular acceleration (with slip).

α = _____