ME 104: Homework 10

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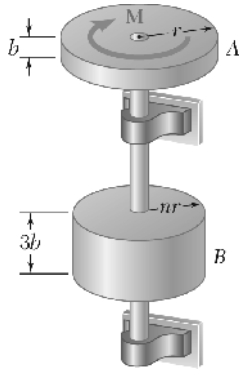
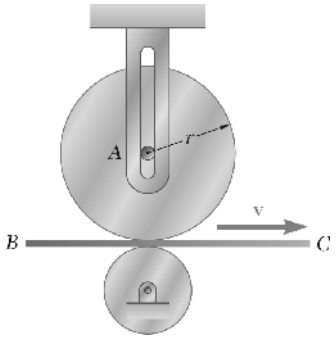
Chapter 17, Problem 3



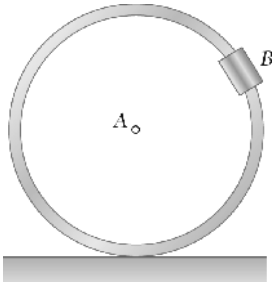
Two disks of the same material are attached to a shaft as shown. Disk *A* is of radius *r* and has a thickness *b*, while disk *B* is of radius *nr* and thickness 3*b*. A couple **M** of constant magnitude is applied when the system is at rest and is removed after the system has executed 2 revolutions. Determine the value of *n* which results in the largest final speed for a point on the rim of disk *B*.

Chapter 17, Problem 7



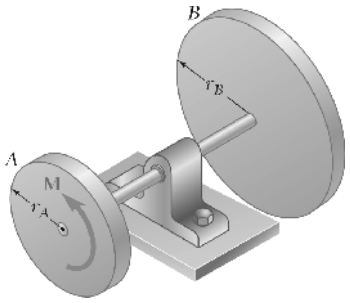
Disk *A* is of constant thickness and is at rest when it is placed in contact with belt *BC*, which moves with a constant velocity **v**. Denoting by μ_k the coefficient of kinetic friction between the disk and the belt, derive an expression for the number of revolutions executed by the disk before it attains a constant angular velocity.

Chapter 17, Problem 28



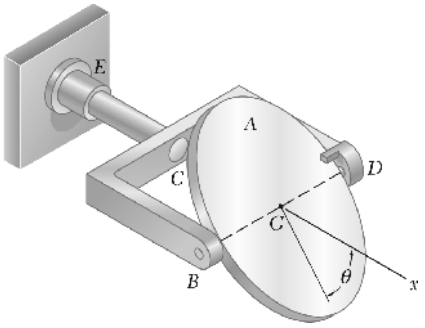
A collar *B*, of mass *m* and of negligible dimension, is attached to the rim of a hoop of the same mass *m* and of radius *r* that rolls without sliding on a horizontal surface. Determine the angular velocity $\boldsymbol{\omega_1}$ of the hoop in terms of *g* and *r* when *B* is directly above the center *A*, knowing that the angular velocity of the hoop is $3\boldsymbol{\omega_1}$ when *B* is directly below *A*.

Chapter 17, Problem 55



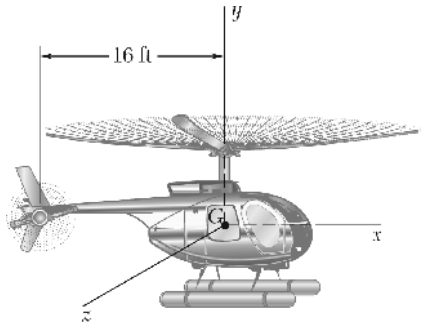
Two disks of the same thickness and same material are attached to a shaft as shown. The 3-kg disk *A* has a radius $r_A = 100$ mm, and disk *B* has a radius $r_B = 125$ mm. Knowing that the angular velocity of the system is to be increased from 200 rpm to 800 rpm during a 3-s interval, determine the magnitude of the couple **M** that must be applied to disk *A*.

Chapter 17, Problem 79



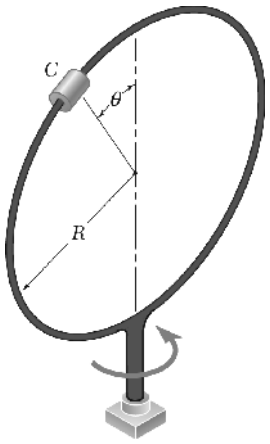
A 2.5-lb disk of radius 4 in. is attached to the yoke *BCD* by means of short shafts fitted in bearings at *B* and *D*. The 1.5-lb yoke has a radius of gyration of 3 in. about the *x* axis. Initially the assembly is rotating at 120 rpm with the disk in the plane of the yoke ($\theta = 0$). If the disk is slightly disturbed and rotates with respect to the yoke until $\theta = 90°$, where it is stopped by a small bar at *D*, determine the final angular velocity of the assembly.

Chapter 17, Problem 85



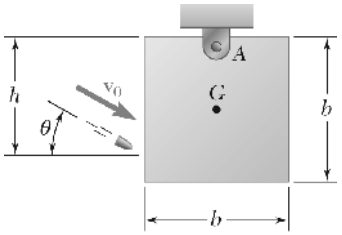
Assuming that the tail propeller in Problem 17.84 is operating and that the angular velocity of the cab remains zero, determine the final horizontal velocity of the cab when the speed of the main blades is changed from 180 to 240 rpm. The cab weighs 1250 lb and is initially at rest. Also determine the force exerted by the tail propeller if the change in speed takes place uniformly in 12 s.

Chapter 17, Problem 88



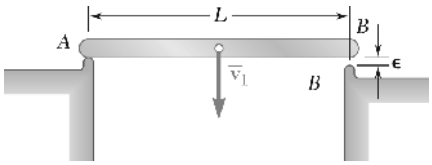
A small 2-kg collar *C* can slide freely on a thin ring of mass 3 kg and radius 250 mm. The ring is welded to a short vertical shaft, which can rotate freely in a fixed bearing. Initially the ring has an angular velocity of 35 rad/s and the collar is at the top of the ring $(\theta = 0)$ when it is given a slight nudge. Neglecting the effect of friction, determine (*a*) the angular velocity of the ring as the collar passes through the position $\theta = 90°$, (*b*) the corresponding velocity of the collar relative to the ring.

Chapter 17, Problem 98



A 45-g bullet is fired with a velocity of 400 m/s at $\theta = 30°$ into a 9-kg square panel of side $b = 200$ mm. Knowing that $h = 150$ mm and that the panel is initially at rest, determine (*a*) the velocity of the center of the panel immediately after the bullet becomes embedded, (*b*) the impulsive reaction at *A*, assuming that the bullet becomes embedded in 2 ms.

Chapter 17, Problem 106



A uniform slender rod of length L is dropped onto rigid supports at A and B. Since support B is slightly lower than support A, the rod strikes A with a velocity $\bar{\mathbf{v}}_1$ before it strikes B. Assuming perfectly elastic impact at both A and B, determine the angular velocity of the rod and the velocity of its mass center immediately after the rod (*a*) strikes support A, (*b*) strikes support B, (*c*) again strikes support A.