

- 25% 1. A particle M as shown in figure 1 moves under gravity along a helix wrapped around a cylinder, which has radius r and rotates at a constant angular speed of ω . The angle between the helix and the horizontal plane is α .
- Write the velocity and acceleration of the particle in terms of cylindrical coordinates.
 - What are the velocity and acceleration along the helix path?

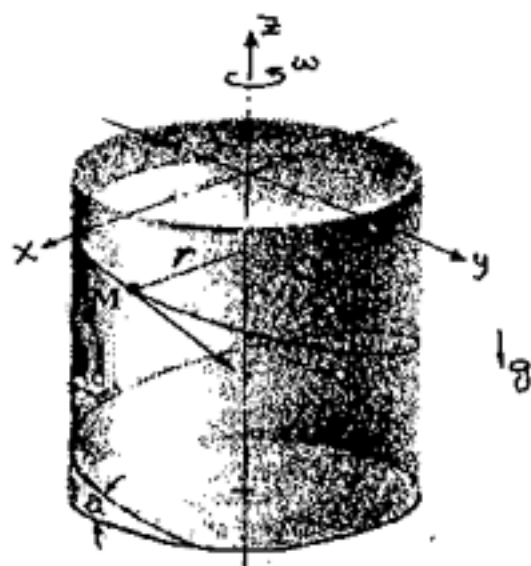


Figure 1

- 25% 2. A sleeve M of mass 600g slides on the guide CD , which rotates with the shaft GG at an angular speed of 300rpm. If the friction between M and CD is $\mu_s = 0.25$. Determine the minimum and maximum values of S where M will remain stationary relative to CD .

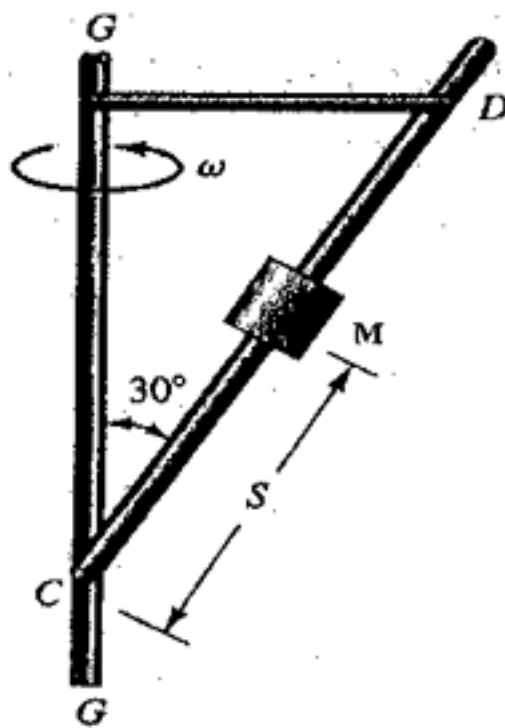


Figure 2

25% 3. Spool B is at rest and spool A is rotating at 4 rad/s when the loose part in the cord connecting them is taken up. Determine the angular velocity of each spool immediately after the cord is jerked tight. The weight of the cord is negligible. The spools A and B have weights and radii of gyration $W_A = 100N$, $k_A = 0.24m$ and $W_B = 50N$, $k_B = 0.18m$, respectively.

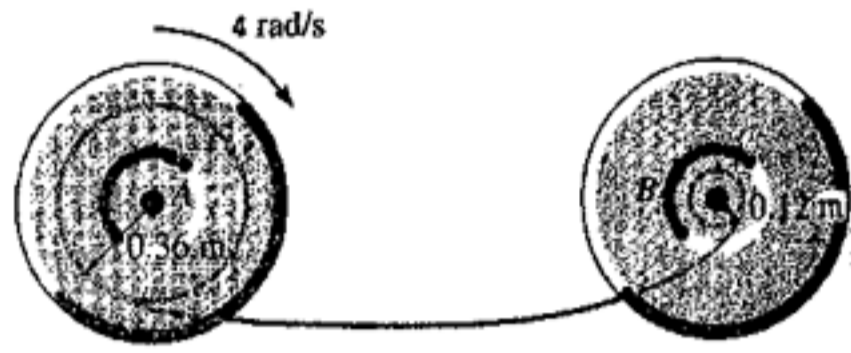


Figure 3

25% 4. A thin disc weighing 9.81N rotates on rod AB at a speed $\omega_2 = 100$ rad/sec as shown in Figure 4. The radius of the disc is 0.5m and the disc is located 3 m from the centerline of the shaft CD, to which rod AB is fixed. Shaft CD rotates at $\omega_1 = 50$ rad/sec. Find the forces and moments on rod AB at the end A due to the disc.

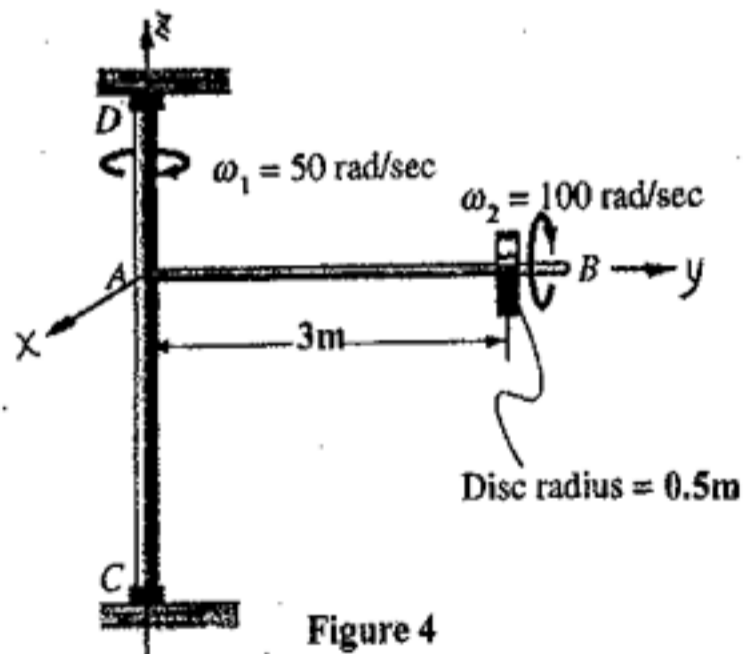


Figure 4