

1. (25%) The uniform rod of length L and weight W is supported on the smooth planes as shown in Fig. 1. Neglecting the thickness of the rod, please determine its position θ in terms of ϕ and ψ for equilibrium.

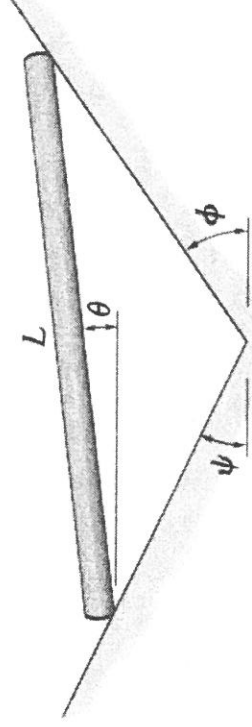


Fig. 1

2. (25%) The aircraft-hangar door opens and closes slowly by means of a motor which draws in the cable AB as shown in Fig. 2. The door is made in two sections (bifold) and each section has a uniform weight W and length L . The sections are pin connected at C and D and the bottom is attached to a roller that travels along the vertical track. Please determine the force in the cable as a function of the door's position.

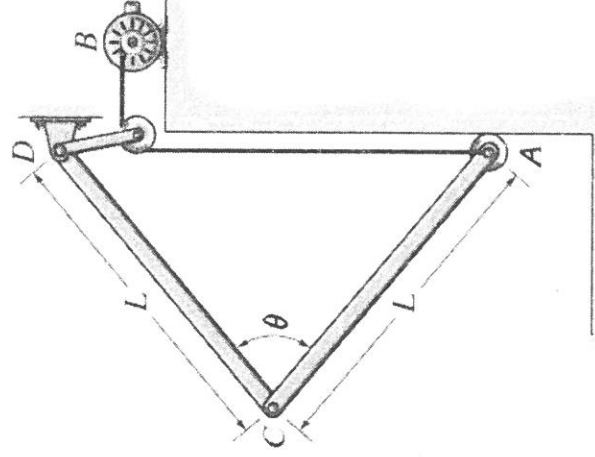


Fig. 2

3. (25%) Two disks with the same radius r roll without slipping on each other and on the floor, as shown in Fig. 3. Give that the angular rate Ω is constant and $\omega = \dot{\theta}$ is constant. Determine the acceleration of point P in terms of $\hat{i}\hat{j}$ coordinate system.

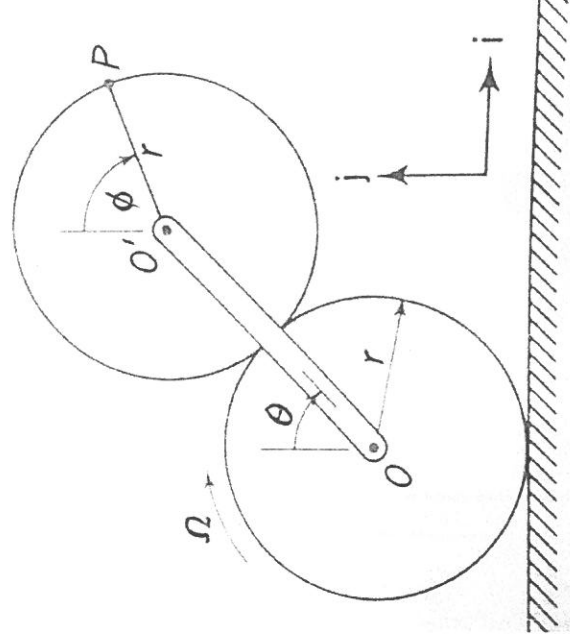


Fig. 3

4. (25%) A massless disk of radius R has an embedded particle of mass m at a distance $\frac{R}{2}$ from the center. The disk is released from rest in the position as shown in Fig. 4, and rolls without slipping down the fixed inclined plane. Determine the angular rate $\dot{\theta}$ in terms of θ , g , and R .

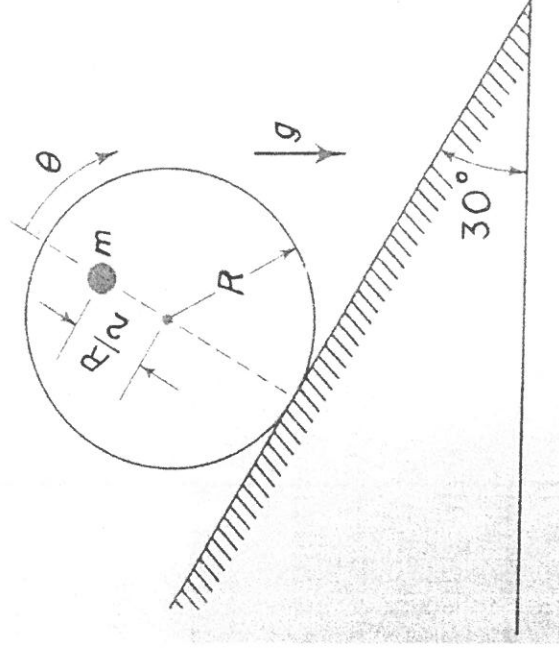


Fig. 4