Tutorial # 2: Planar Kinematics

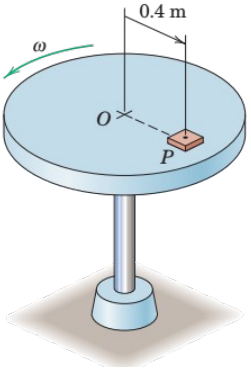

Figure 1

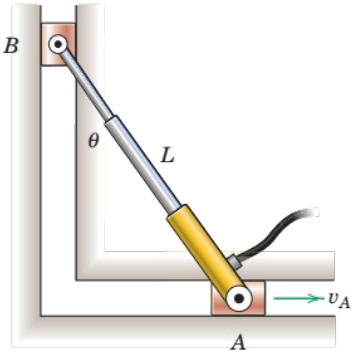

Figure 2

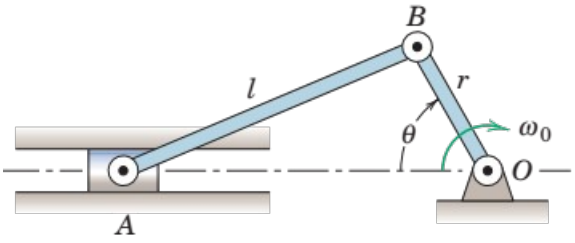

Figure 3

Q1. In order to test an intentionally weak adhesive, the bottom of the small 0.3-kg block is coated with adhesive and then the block is pressed onto the turntable with a known force as shown in Figure 1. The turntable starts from rest at time $t = 0$ and uniformly accelerates with $\alpha = 2$ rad/s^2. If the adhesive fails at exactly $t = 3$ s, determine the ultimate shear force which the adhesive supports. What is the angular displacement of the turntable at the time of failure?

Q2. At the instant under consideration, the hydraulic cylinder *AB* has a length $L = 0.75$ m, and this length is momentarily increasing at a constant rate of 0.2 m/s. If $v_A = 0.6$ m/s and $\theta = 35°$, determine the velocity of slider *B*.

Q3. In the slider crank mechanism shown in Figure 3, express the angular velocity ω_{AB} and angular acceleration α_{AB} of the connecting rod *AB* in terms of the angle θ of the crank *OB* rotating at a given constant angular speed ω_0. Take ω_{AB} and α_{AB} to be positive counterclockwise.

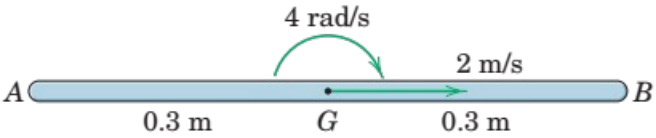

Figure 4

Q4. Figure 4 shows a slender bar moving in general plane motion with the indicated linear and angular properties. Locate the instantaneous center of zero velocity and determine the speeds of points A and B.

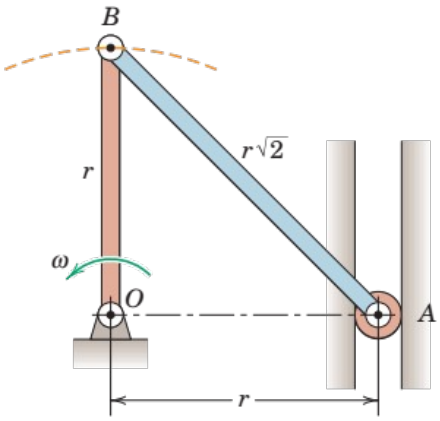

Figure 5

Q5. Determine the angular acceleration α_{AB} of *AB* for the position shown in Figure 5 if link *OB* has a constant angular velocity ω.