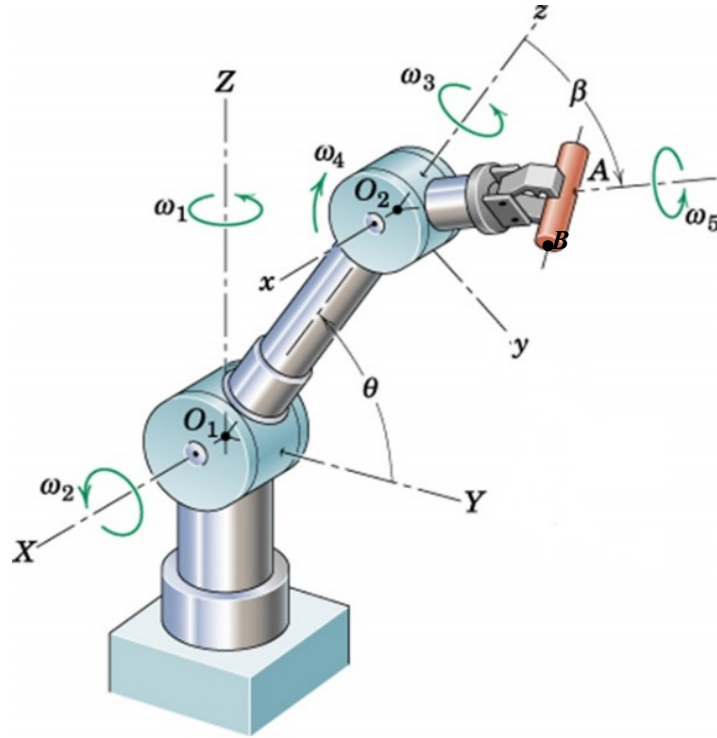
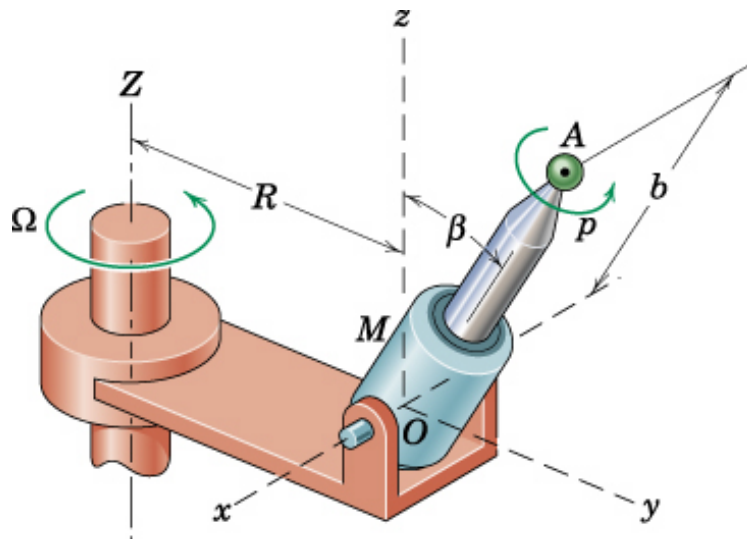


**ESO209A: Dynamics: Tutorial 7**  
(Week: 15 - 22 Sep. Based on L12)

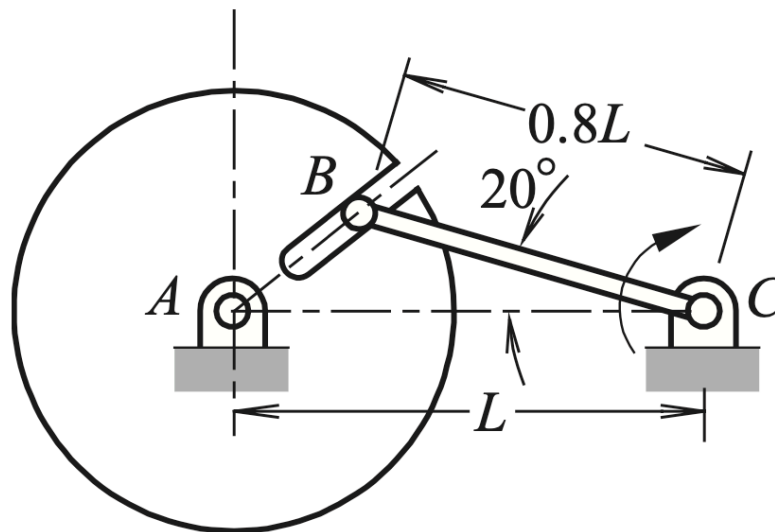
(1) Consider the robotic arm as shown.  $O_1$ - $XYZ$  is the ground-fixed frame. For  $\omega_1 = \omega_4 = \omega_5 = 1 \text{ rad/sec}$ ,  $\omega_2 = \omega_3 = 0 \text{ rad/sec}$ ,  $O_1O_2 = 1.2 \text{ m}$ ,  $O_2A = 0.6 \text{ m}$ , and  $AB = 0.2 \text{ m}$  determine the velocity and acceleration of the point  $B$  for the instant when  $\theta = 60^\circ$  and  $\beta = 90^\circ$ .  $A$  is at the centre of the cylinder and  $B$  is at the end.



(2) The polishing tool  $A$  is mounted on a spindle of the motor,  $M$ . The spindle spins at a constant rate of  $p \text{ rad/sec}$  as shown. The motor-spindle unit rotates about  $Z$ -axis at the constant angular speed of  $\Omega \text{ rad/sec}$  and simultaneously tilts about  $z$ -axis at a constant rate of  $\dot{\beta} \text{ rad/sec}$ . Determine the angular acceleration of the spindle  $OA$  in terms of  $\beta$  in  $O$ - $xyz$  frame.



- (3) The figure below shows a mechanism in which the slotted disk rotates at the angular speed. Determine the angular acceleration of the connecting rod BC at the instant shown.



- (4) The bar AB in the figure below rotates at the constant rate  $\omega_{AB}$ , which causes the collar B to slide along the curved bar CD. For the instant shown, find the angular acceleration of the curved bar CD and the acceleration of the collar B.

