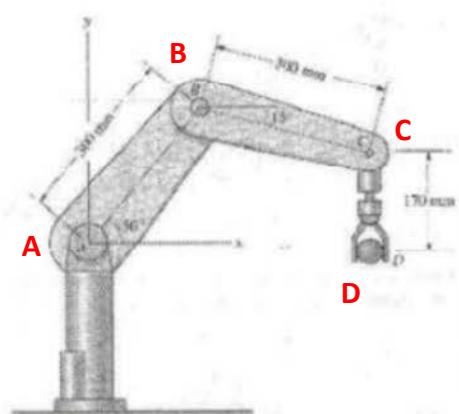


# EGM 3420C - Engineering Mechanics

## Dynamics Review Problems

**Problem 1.** If arm AB has a constant clockwise angular velocity of 0.8 rad/s, arm BC has a constant clockwise angular velocity of 0.2 rad/s, and arm CD remains vertical, what is the acceleration of part D?



Classify Motion

AB - RAFA

BC - GPM

Note:

- \* pt B connects
- \*  $\alpha_c = \alpha_D$

\* constant velocity =  
accel of zero!  
(body properties)

Write Accel. Eqs

$$\vec{a}_B = \vec{a}_A + \vec{a}_{B/A} = \vec{a}_c + \vec{a}_{B/C}$$

Draw Kinematic Diagrams

$$\begin{array}{l} \text{A} \\ \text{fixed} \\ + \\ \text{Angular } \omega_{AB} = 0.8 \text{ rps} \\ \text{Radius } r = 0.3 \text{ m} \\ \text{Angle } \theta = 50^\circ \\ \text{Centrifugal Acceleration } a_{cent} = \omega^2 r = (0.8)^2 (0.3) = 19.2 \end{array}$$

$$\begin{matrix} a_{cy} \\ a_{cx} \end{matrix}$$

$$\begin{array}{l} a_{AB} \\ a_{T_{AB}} \\ a_{T_{BC}} \\ a_{BC} = 0 \\ a_{BC} = \omega^2 r = (0.2)^2 (0.17) = 0.068 \text{ m/s}^2 \end{array}$$

Solve Eqs

$$0 - 19.2 \cos 50^\circ = a_{cx} + 12 \cos 15^\circ \Rightarrow a_{cx} = -135 \text{ mm/s}^2$$

$$0 - 19.2 \sin 50^\circ = a_{cy} - 12 \sin 15^\circ \Rightarrow a_{cy} = -144 \text{ mm/s}^2$$

$$a = \sqrt{135^2 + 144^2} = 197.4 \text{ mm/s}^2 \text{ at } 47^\circ$$

Answer:  $a_c = 197.4 \text{ mm/s}^2$  at  $47^\circ$  CCW from horizontal