

MECH230 - Fall 2024

Recommended Problems - Set 11

Theresa Honein

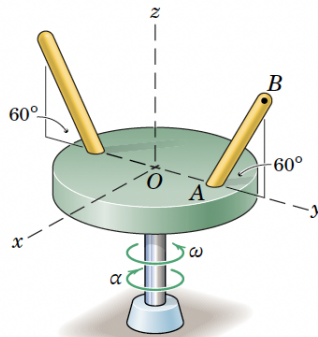
October 14, 2024

The problems are taken from J. L. Meriam, L. G. Kraige, and J. N. Bolton (MKB), Engineering Mechanics: Dynamics, Ninth Edition, Wiley, New York, 2018.

In the following problems, feel free to introduce corrotational basis vectors as you see fit.

1. [MKB 05-010]

5/10 The device shown rotates about the fixed z -axis with angular velocity $\omega = 20 \text{ rad/s}$ and angular acceleration $\alpha = 40 \text{ rad/s}^2$ in the directions indicated. Determine the instantaneous velocity and acceleration of point B .

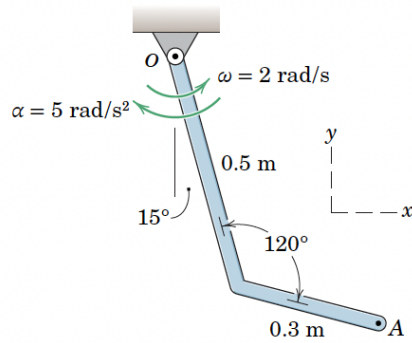


$$\overline{OA} = 300 \text{ mm}, \overline{AB} = 500 \text{ mm}$$

PROBLEM 5/10

2. [MKB 05-013]

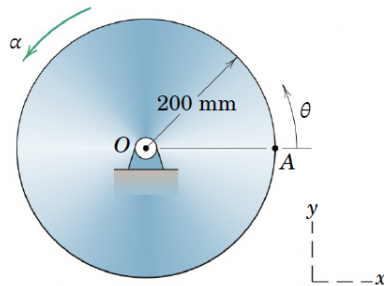
5/13 The bent flat bar rotates about a fixed axis through point O with the instantaneous angular properties indicated in the figure. Determine the velocity and acceleration of point A .



PROBLEM 5/13

3. [05-018]

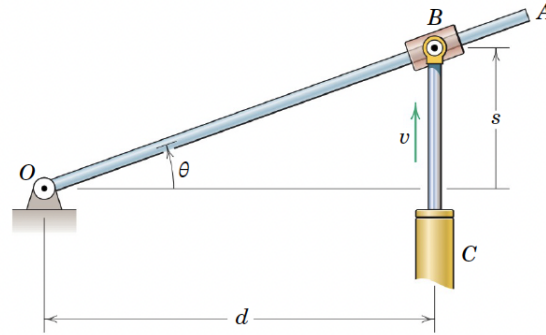
5/18 Point A of the circular disk is at the angular position $\theta = 0$ at time $t = 0$. The disk has angular velocity $\omega_0 = 0.1 \text{ rad/s}$ at $t = 0$ and subsequently experiences a constant angular acceleration $\alpha = 2 \text{ rad/s}^2$. Determine the velocity and acceleration of point A in terms of fixed \mathbf{i} and \mathbf{j} unit vectors at time $t = 1 \text{ s}$.



PROBLEM 5/18

4. [05-023]

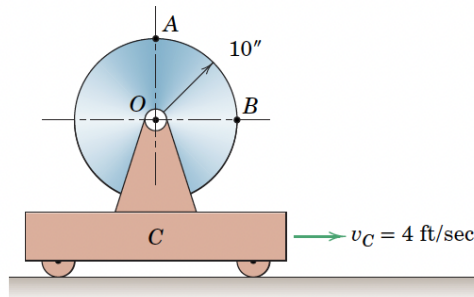
5/23 The fixed hydraulic cylinder C imparts a constant upward velocity v to the collar B , which slips freely on rod OA . Determine the resulting angular velocity ω_{OA} in terms of v , the displacement s of point B , and the fixed distance d .



PROBLEM 5/23

5. [05-049]

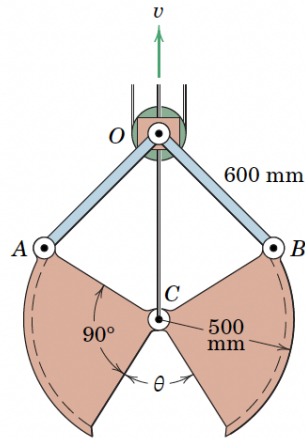
5/49 The cart has a velocity of 4 ft/sec to the right. Determine the angular speed N of the wheel so that point A on the top of the rim has a velocity (a) equal to 4 ft/sec to the left, (b) equal to zero, and (c) equal to 8 ft/sec to the right.



PROBLEM 5/49

6. [05-065]

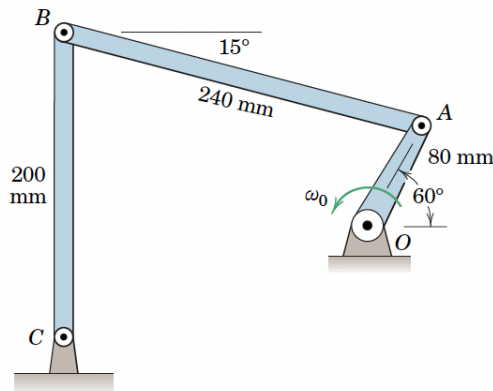
5/65 The elements of a simplified clam-shell bucket for a dredge are shown. The cable which opens and closes the bucket passes through the block at O . With O as a fixed point, determine the angular velocity ω of the bucket jaws when $\theta = 45^\circ$ as they are closing. The upward velocity of the control cable is 0.5 m/s as it passes through the block.



PROBLEM 5/65

7. [05-069]

5/69 SS A four-bar linkage is shown in the figure (the ground "link" OC is considered the fourth bar). If the drive link OA has a counterclockwise angular velocity $\omega_0 = 10$ rad/s, determine the angular velocities of links AB and BC .



PROBLEM 5/69