MECH230 - Fall 2024
Recommended Problems - Set 12

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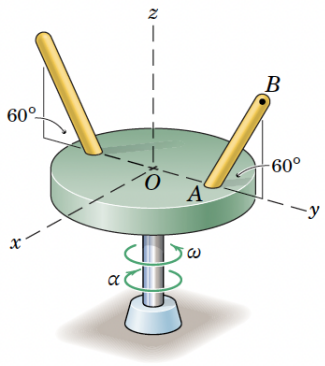
Velocity and Acceleration Analysis for Material Points on a RB

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 $\omega = 20$ rad/s and angular acceleration $\alpha = 40$ rad/s^2 in the directions indicated. Determine the instantaneous velocity and acceleration of point B.



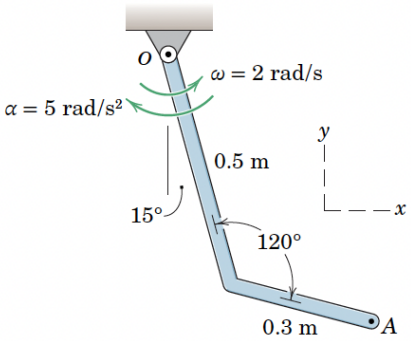
$\overline{OA} = 300$ mm, $\overline{AB} = 500$ mm

PROBLEM 5/10

Compiled on 11/04/2024 at 1:25pm

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.



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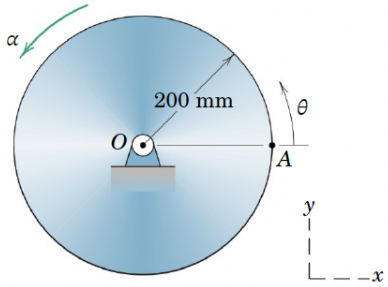
3. [05-018]

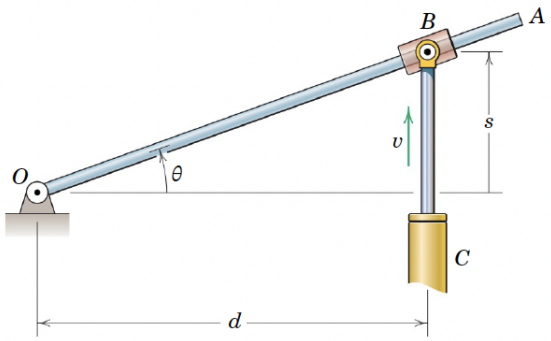
5/18 Point A of the circular disk is at the angular position $\theta = 0$ at time $t = 0$. The disk has angular velocity $\omega_0 = 0.1$ rad/s at $t = 0$ and subsequently experiences a constant angular acceleration $\alpha = 2$ rad/s^2. Determine the velocity and acceleration of point A in terms of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



PROBLEM 5/18

4. [05-023]

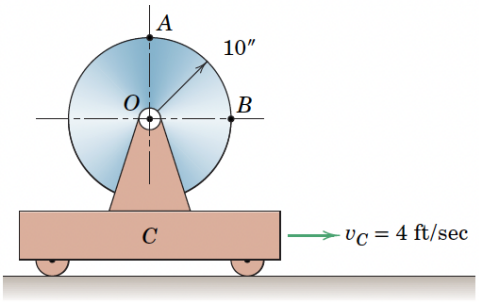
5/23 The fixed hydraulic cylinder C imparts a constant upward velocity v to the collar B, which slips freely on rod OA. Determine the resulting angular velocity ω_{OA} in terms of v, the displacement s of point B, and the fixed distance d.



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.



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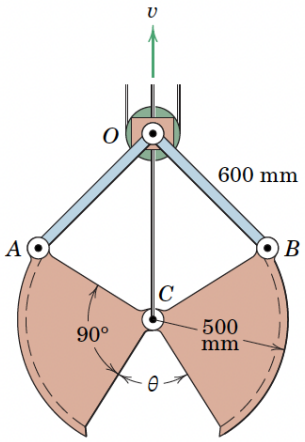
6. [05-065]

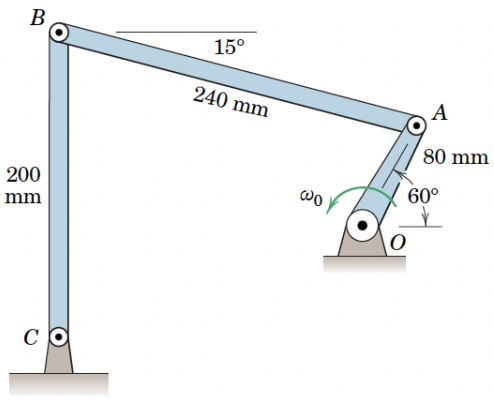
5/65 The elements of a simplified clam-shell bucket for a dredge are shown. The cable which opens and closes the bucket passes through the block at O. With O as a fixed point, determine the angular velocity ω of the bucket jaws when $\theta = 45°$ as they are closing. The upward velocity of the control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



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