DYNAMICS

دانشگاه کردستان
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- Vector Mechanics for Engineers: Dynamics, 10th edition. Ferdinand Beer- E. Russell Johnston Jr. - Phillip Cornwell.
- Engineering Mechanics-Dynamics, 7th Edition. J. L. Meriam, L. G. Kraige.
- Other Reference: Brain P.Self "Lectures notes on Dynamics"

Kinematics of Rigid Bodies

(Homework-04)

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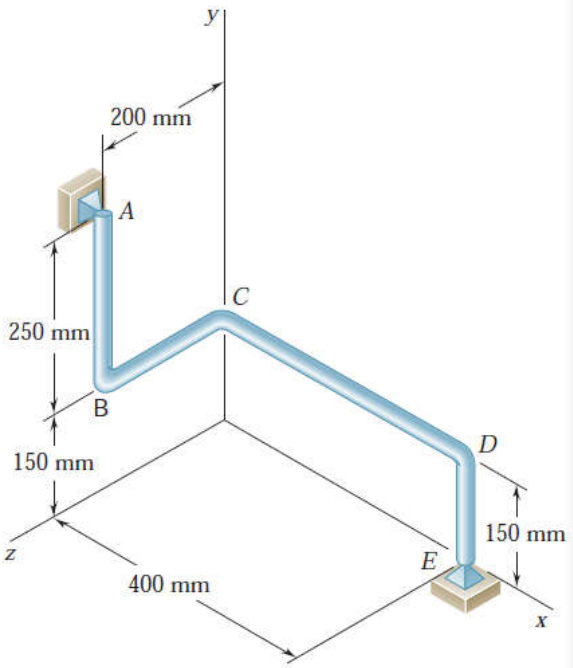
سینماتیک اجسام صلب

❑ سوال ۱

The bent rod ABCDE rotates about a line joining points A and E with a constant angular velocity of 9 rad/s. Knowing that the rotation is clockwise as viewed from E, determine a) the velocity and acceleration of corner C. b) the velocity and acceleration of corner B, assuming that the angular velocity is 9 rad/s and increases at the rate of 45 rad/s^2 .



Key Answer:

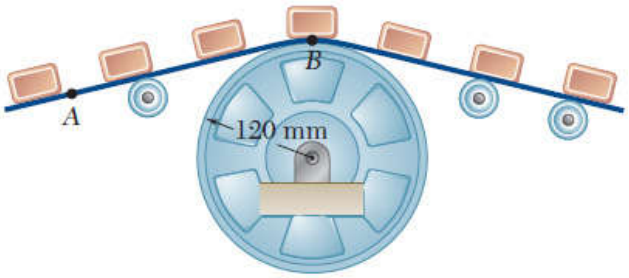
a) $-(0.450\ \text{m/s})\mathbf{i} - (1.200\ \text{m/s})\mathbf{j} + (1.500\ \text{m/s})\mathbf{k}$, $(12.60\ \text{m/s}^2)\mathbf{i} + (7.65\ \text{m/s}^2)\mathbf{j} + (9.90\ \text{m/s}^2)\mathbf{k}$.

b) $(0.750\ \text{m/s})\mathbf{i} + (1.500\ \text{m/s})\mathbf{k}$, $(12.75\ \text{m/s}^2)\mathbf{i} + (11.25\ \text{m/s}^2)\mathbf{j} + (3.00\ \text{m/s}^2)\mathbf{k}$.

سینماتیک اجسام صلب

❑ سوال ۲

A series of small machine components being moved by a conveyor belt pass over a 120-mm-radius idler pulley. At the instant shown, the velocity of point A is 300 mm/s to the left and its acceleration is 180 mm/s^2 to the right. Determine (a) the angular velocity and angular acceleration of the idler pulley, (b) the total acceleration of the machine component at B.

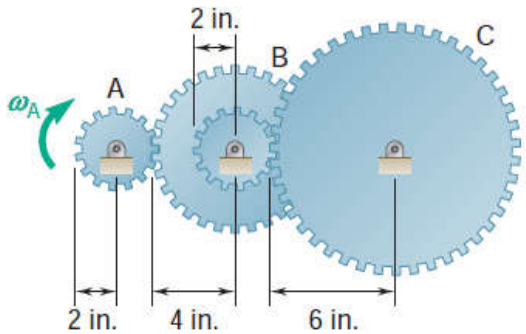


Key Answer: (*a*) 2.50 rad/s l, 1.500 rad/s^2 i. (*b*) 771 mm/s^2 ⊂ 76.5°.

سینماتیک اجسام صلب

❑ سوال ۳

A gear reduction system consists of three gears A, B, and C. Knowing that gear A rotates clockwise with a constant angular velocity $V_A = 600$ rpm, determine (a) the angular velocities of gears B and C, (b) the accelerations of the points on gears B and C which are in contact.

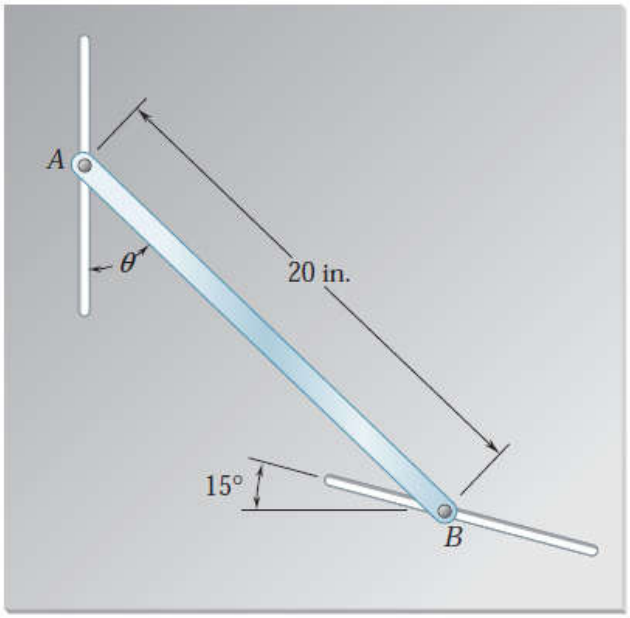


Key Answer: (*a*) 300 rpm l, 100 rpm i. (*b*) $\mathbf{a}_B$ = 1974 in/s^2 z, $\mathbf{a}_C$ = 658 in/s^2 y.

سینماتیک اجسام صلب

❑ سوال ۴

The motion of rod AB is guided by pins attached at A and B which slide in the slots shown. At the instant shown, $u = 40^\circ$ and the pin at B moves upward to the left with a constant velocity of 6 in./s. Determine (a) the angular velocity of the rod, (b) the velocity of the pin at end A.

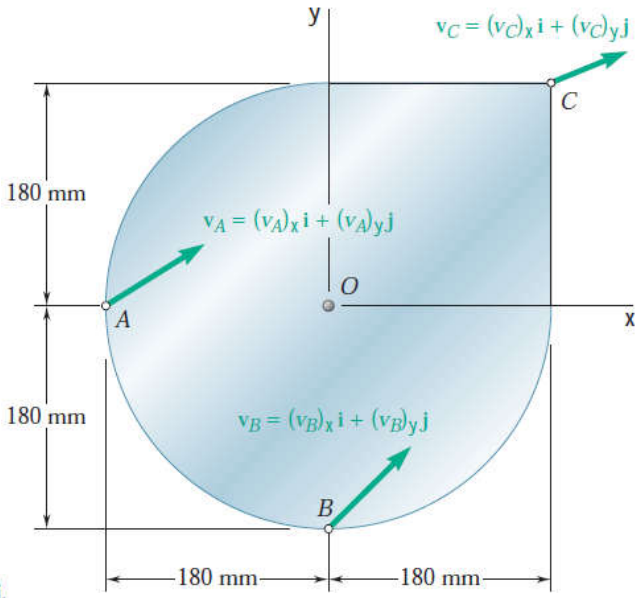


Key Answer: (a) 0.378 rad/s i. (b) 6.42 in/s x.

سینماتیک اجسام صلب

❑ سوال ۵

The plate shown moves in the xy plane. Knowing that $(v_A)_x = 120\ mm/s$, $(v_B)_y = 300\ mm/s$ and $(v_C)_y = -60\ mm/s$, determine (a) the angular velocity of the plate, (b) the velocity of point A.

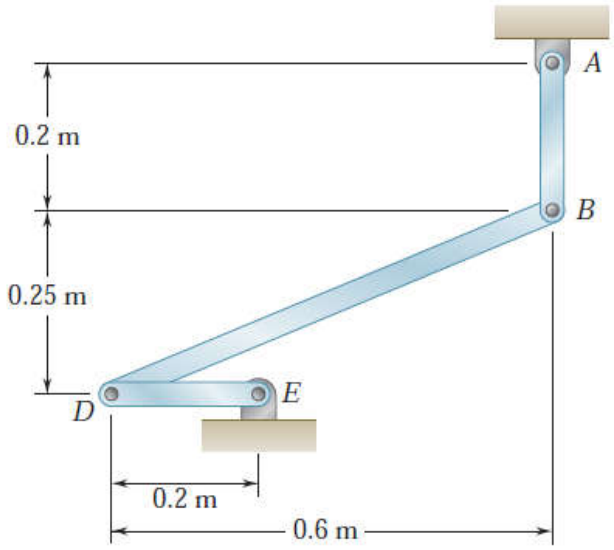


Key Answer: (a) 2.00 rad/s i. (b) (120 mm/s)**i** + (660 mm/s)**j**.

سینماتیک اجسام صلب

❑ سوال ۶

Knowing that at the instant shown the angular velocity of rod AB is 15 rad/s clockwise, determine (a) the angular velocity of rod BD, (b) the velocity of the midpoint of rod BD.



Key Answer: (a) 12.00 rad/s l. (b) 3.90 m/s ◁ 67.4°.