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Series 3

Exercise 1 *The fixed hydraulique cylinder C imparts a constant upward velocity v to the collar B, which slips freely on rod OA shown in the figure 1.*

1. *Determine the resulting angular velocity OA in terms of v, the displacement s of point B, and the fixed distance d.*

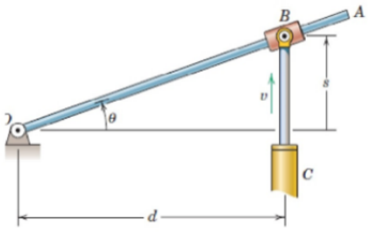

Figure 1: The hydraulique cylinder

Exercise 2 *The plate ABD and the rod OB are tightly fixed and rotate around the ball joint O with an angular velocity :*
$\vec{\omega} = 1.5\vec{i} + \omega_y\vec{j} + \omega_z\vec{k}$ *rad/s*
The speed of Point A is given in the position shown in (Fig.2):
$\vec{v}_A = 0.08\vec{i} - 0.36\vec{j} + v_{Az}\vec{k}$ *m/s*
Calculate
1.The rotation speed of the system,
2.The speed of point D.

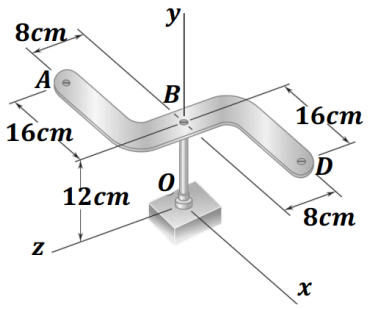

Figure 2: The plate.

Exercise 3 *A 5 m long steel beam is lowered horizontally by two cables which run at the same speed (Fig. 3.). When the beam approaches the ground, the crane operators apply brakes to slow down the unwinding movement. At the instant considered, the deceleration of the cable connected at B is 2.5* $\frac{m}{s^2}$*, while that of the cable connected at D is 1.5* $\frac{m}{s^2}$*. Determine :*

1. *The angular acceleration of the beam.*
2. *The acceleration of points A and E.*

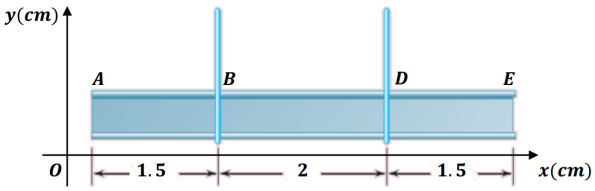

Figure 3: The Beam.

Exercise 4 *In the illustrated engine system (Fig.4),$l = 160$ mm and $b = 60$ mm.Knowing that the crank AB rotates at a constant angular speed of l =1000 rpm in the clockwise direction. For $\theta = 0$ and $\theta = 90$, determine: the angular velocity of the connecting rod BD and the speed of the piston P.*

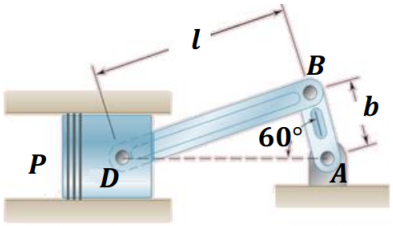

Figure 4: the engine system.

Exercise 5 *In an oil pump platform (Fig.5.), the link AB causes the beam BCE to oscillate when the axis OA of the crank turns. Knowing that OA has a radius of 0.6 m and a constant clockwise angular velocity of 20 rpm, determine at the indicated instant:*

1. *The speed of the point D.*
2. *Its acceleration.*

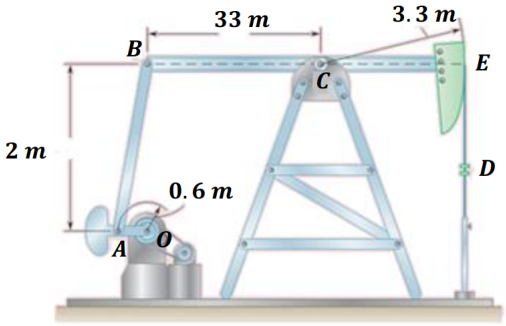

Figure 5: The pump.

Exercise 6 *An arm OA of length L rotates about the vertical axis Oz with a constant $\vec{\omega}_1$. A disk D of radius R is attached to the arm so that its center coincides with point A. The arm and the disk are located in the same plane. The disk rotates around A with a constant speed $\vec{\omega}_2$ (Fig.6.). Determine:*

1. *The speed of the point P located directly above A.*
2. *The acceleration of P.*
3. *The angular velocity and the angular acceleration of the disk.*

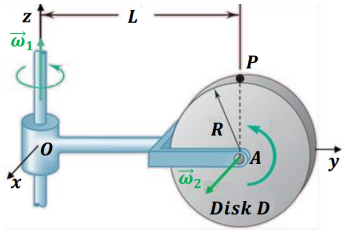

Figure 6: The arm and the disk.