DİNAMİK SINAVLARA HAZIRLIK, ÇALIŞMA SORULARI

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Örnek

At the instant $\theta = 50°$, the slotted guide is moving upward with an acceleration of $3\ m/s^2$ and a velocity of $2\ m/s$. Determine the angular acceleration and angular velocity of link AB at this instant. *Note:* The upward motion of the guide is in the negative y direction.

$y = 0.3\cos\theta$

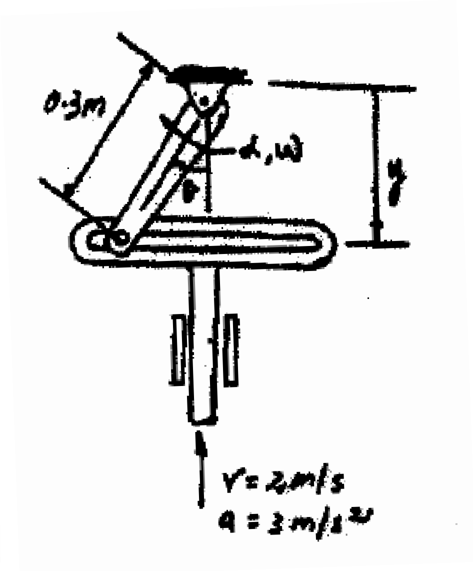
$\dot{y} = v_y = -0.3\sin\theta\dot{\theta}$

$\ddot{y} = a_y = -0.3(\sin\theta\ddot{\theta} + \cos\theta\dot{\theta}^2)$

Here $v_y = -2$ m/s, $a_y = -3\ m/s^2$, and $\dot{\theta} = \omega$, $\ddot{\theta} = \alpha$, $\theta = 50°$.

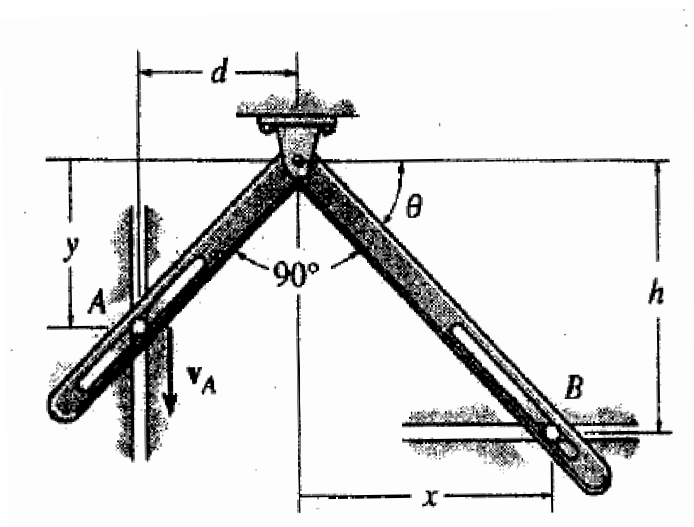
$-2 = -0.3\sin 50°(\omega)$ $\qquad \omega = 8.70$ rad/s $\qquad$ Ans

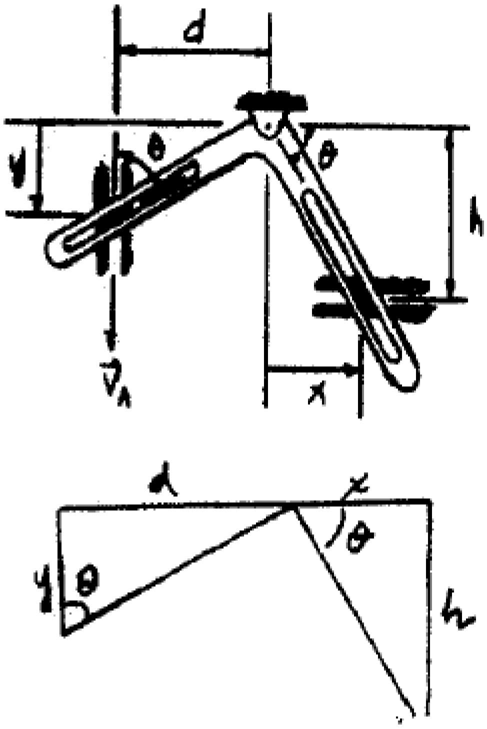
$-3 = -0.3[\sin 50°(\alpha) + \cos 50°(8.70)^2]$ $\qquad \alpha = -50.5\ rad/s^2$ $\qquad$ Ans



Örnek

The pins at A and B are confined to move in the vertical and horizontal tracks. If the slotted arm is causing A to move downward at $\mathbf{v}_A$, determine the velocity of B at the instant shown.





Position coordinate equation : $\tan\theta = \frac{h}{x} = \frac{d}{y}$

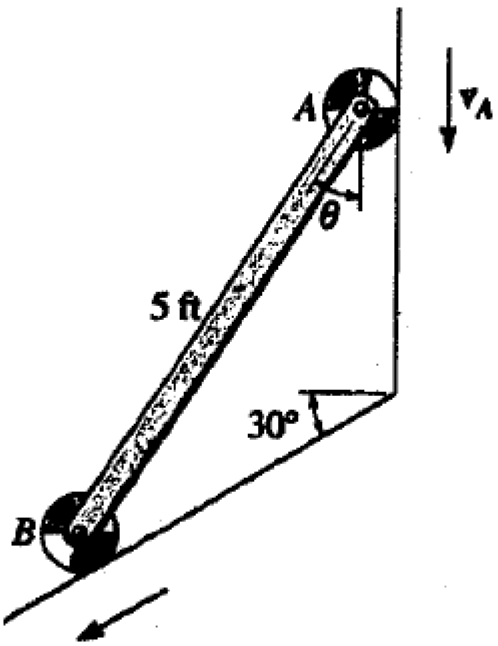
Time derivatives : $x = \left(\frac{h}{d}\right)y$

$\dot{x} = \left(\frac{h}{d}\right)\dot{y}$

$v_B = \left(\frac{h}{d}\right)v_A$ **Ans**

Örnek

The bar is confined to move along the vertical and inclined planes. If the velocity of the roller at A is $v_A = 6$ ft/s when $\theta = 45°$, determine the bar's angular velocity and the velocity of roller B at this instant



$s_B = 5.774 \sin\theta$

$\dot{s}_B = 5.774 \cos\theta\ \dot{\theta}$ (1)

$5\cos\theta = s_A + s_B \sin 30°$

$-5\sin\theta\ \dot{\theta} = \dot{s}_A + \dot{s}_B \sin 30°$ (2)

Combine Eqs.(1) and (2) :

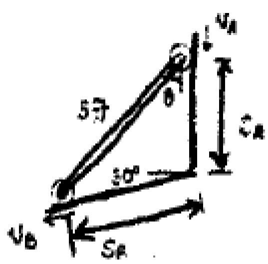
$-5\sin\theta\ \dot{\theta} = -6 + 5.774\cos\theta(\dot{\theta})(\sin 30°)$

$-3.536\dot{\theta} = -6 + 2.041\dot{\theta}$

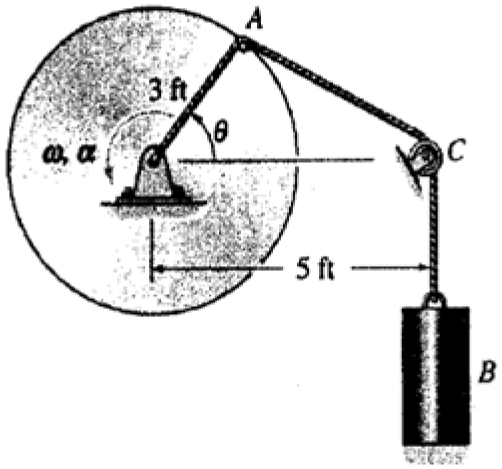
$\omega = \dot{\theta} = 1.08$ rad/s **Ans**

From Eq.(1) :

$v_B = \dot{s}_B = 5.774\cos 45°(1.076) = 4.39$ ft/s **Ans**



Örnek

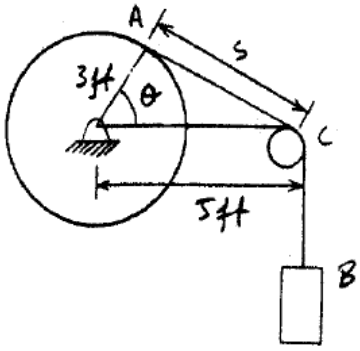


The disk is rotating with an angular velocity of ω and has an angular acceleration of α. Determine the velocity and acceleration of cylinder B. Neglect the size of the pulley at C.

$$s = \sqrt{3^2 + 5^2 - 2(3)(5)\cos\theta}$$

$$v_B = \dot{s} = \frac{1}{2}(34 - 30\cos\theta)^{-\frac{1}{2}}(30\sin\theta)\,\dot{\theta}$$

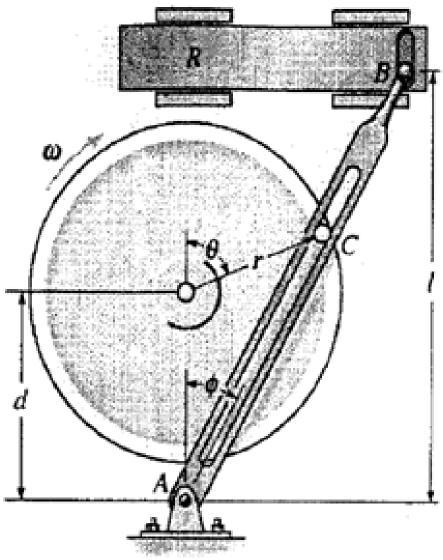
$$v_B = \frac{15\omega\sin\theta}{(34 - 30\cos\theta)^{\frac{1}{2}}} \qquad \textbf{Ans}$$



$$a_B = \ddot{s} = \frac{15\omega\cos\theta\,\dot{\theta} + 15\dot{\omega}\sin\theta}{\sqrt{34 - 30\cos\theta}} + \frac{\left(-\frac{1}{2}\right)(15\omega\sin\theta)\left(30\sin\theta\,\dot{\theta}\right)}{(34 - 30\cos\theta)^{\frac{3}{2}}}$$

$$= \frac{15(\omega^2\cos\theta + \alpha\sin\theta)}{(34 - 30\cos\theta)^{\frac{1}{2}}} - \frac{225\omega^2\sin^2\theta}{(34 - 30\cos\theta)^{\frac{3}{2}}} \qquad \textbf{Ans}$$

Örnek



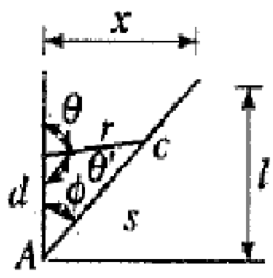
The slotted yoke is pinned at A while end B is used to move the ram R horizontally. If the disk rotates with a constant angular velocity ω, determine the velocity and acceleration of the ram. The crank pin C is fixed to the disk and turns with it.

$x = l\tan\phi$ [1]

However $\dfrac{r}{\sin\phi} = \dfrac{s}{\sin(180^\circ - \theta)} = \dfrac{s}{\sin\theta}$ $\quad \sin\phi = \dfrac{r}{s}\sin\theta$

$d = s\cos\phi - r\cos\theta$ $\quad \cos\phi = \dfrac{d + r\cos\theta}{s}$

From Eq. [1] $\quad x = l\left(\frac{\sin\phi}{\cos\phi}\right) = l\left(\frac{\frac{r}{s}\sin\theta}{\frac{d + r\cos\theta}{s}}\right) = \frac{lr\sin\theta}{d + r\cos\theta}$



$$\dot{x} = v = \frac{(d + r\cos\theta)(lr\cos\theta\dot{\theta}) - (lr\sin\theta)(-r\sin\theta\dot{\theta})}{(d + r\cos\theta)^2} \quad \text{Where } \dot{\theta} = \omega$$

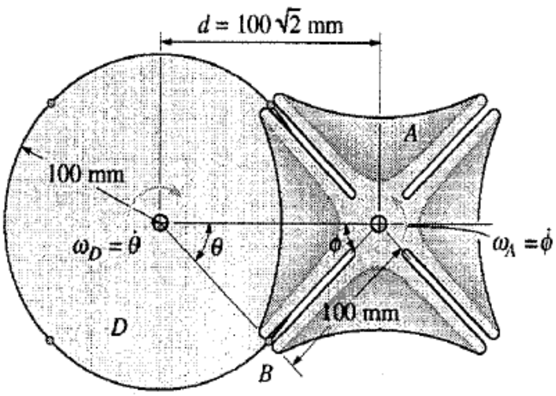
$$= \frac{lr(r + d\cos\theta)}{(d + r\cos\theta)^2}\omega \qquad \textbf{Ans}$$

$$\ddot{x} = a = lr\omega\left[\frac{(d + r\cos\theta)^2(-d\sin\theta\dot{\theta}) - (r + d\cos\theta)(2)(d + r\cos\theta)(-r\sin\theta\dot{\theta})}{(d + r\cos\theta)^4}\right]$$

$$= \frac{lr\sin\theta(2r^2 - d^2 + rd\cos\theta)}{(d + r\cos\theta)^3}\omega^2 \qquad \textbf{Ans}$$

Örnek

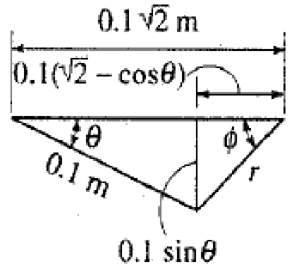
The Geneva wheel A provides intermittent rotary motion ω_A for continuous motion $\omega_D = 2$ rad/s of disk D. By choosing $d = 100\sqrt{2}$ mm, the wheel has zero angular velocity at the instant pin B enters or leaves one of the four slots. Determine the magnitude of the angular velocity ω_A of the Geneva wheel at any angle θ for which pin B is in contact with the slot.



$$\tan\phi = \frac{0.1\sin\theta}{0.1(\sqrt{2} - \cos\theta)} = \frac{\sin\theta}{\sqrt{2} - \cos\theta}$$

$$\sec^2\phi\dot{\phi} = \frac{(\sqrt{2} - \cos\theta)(\cos\theta\dot{\theta}) - \sin\theta(\sin\theta\dot{\theta})}{(\sqrt{2} - \cos\theta)^2} = \frac{\sqrt{2}\cos\theta - 1}{(\sqrt{2} - \cos\theta)^2}\dot{\theta} \qquad [1]$$

From the geometry:



$$r^2 = (0.1\sin\theta)^2 + [0.1(\sqrt{2} - \cos\theta)]^2 = 0.01(3 - 2\sqrt{2}\cos\theta)$$

$$\sec^2\phi = \frac{r^2}{[0.1(\sqrt{2} - \cos\theta)]^2} = \frac{0.01(3 - 2\sqrt{2}\cos\theta)}{[0.1(\sqrt{2} - \cos\theta)]^2} = \frac{(3 - 2\sqrt{2}\cos\theta)}{(\sqrt{2} - \cos\theta)^2}$$

From Eq. [1]

$$\frac{(3 - 2\sqrt{2}\cos\theta)}{(\sqrt{2} - \cos\theta)^2}\dot{\phi} = \frac{\sqrt{2}\cos\theta - 1}{(\sqrt{2} - \cos\theta)^2}\dot{\theta}$$

$$\dot{\phi} = \frac{\sqrt{2}\cos\theta - 1}{3 - 2\sqrt{2}\cos\theta}\dot{\theta}$$ Here $\dot{\phi} = \omega_A$ and $\dot{\theta} = \omega_D = 2$ rad/s

$$\omega_A = 2\left(\frac{\sqrt{2}\cos\theta - 1}{3 - 2\sqrt{2}\cos\theta}\right)$$ **Ans**