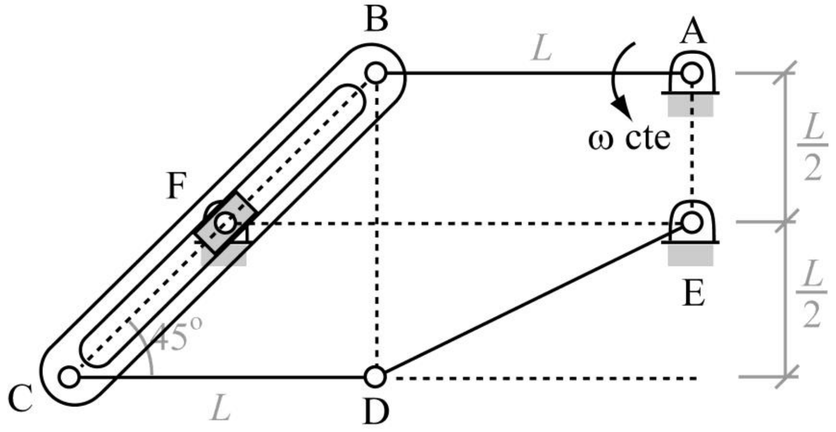
Ejercicio de TEORIA DE MAQUINAS – 2024/2025
Nombre...

La figura muestra un mecanismo formado por cuatro barras articuladas en sus extremos. La barra BC, fabricada en plástico transparente para permitir ver a través de ella, está ranurada, pudiendo deslizar por su ranura el bloque F, articulado al elemento fijo.



Para la posición del mecanismo representada en la figura, en la que la velocidad angular de la barra AB es ω, de sentido saliente y valor constante, determinar:

a) Número de grados de libertad del mecanismo.
b) Velocidad angular de las barras BC, CD y DE.
c) Velocidad relativa del bloque F respecto a la barra BC.
d) Aceleración angular de las barras BC, CD y DE.
e) Aceleración relativa del bloque F respecto a la barra BC.

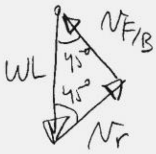
a) $n = 5$
$p_I = 5$
$p_{II} = 1$ $\Bigg\}$ $\boxed{g = 3(5-1) - 2\times 5 - 1 = 1}$

b, c) $\vec{v}_F = \vec{v}_a + \vec{v}_r \quad (BC)$

$\quad \| \qquad \downarrow \qquad ?\ \angle 45°$

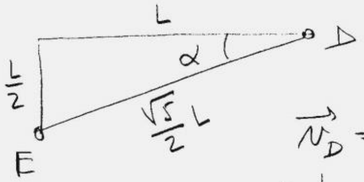
$\quad \vec{0} \qquad \vec{v}_B + \vec{v}_{F/B}$

$\qquad \downarrow \omega L \qquad 45° \ ?$



$\boxed{v_r = \frac{\sqrt{2}}{2}\omega L \quad \angle 45°}$

$v_{F/B} = \frac{\sqrt{2}}{2}\omega L = \omega_{BC}\frac{\sqrt{2}}{2}L \Rightarrow \boxed{\omega_{BC} = \omega \ \text{entr}}$



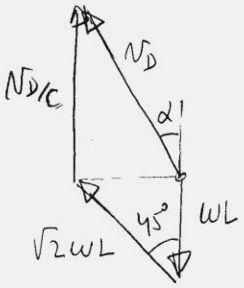
$\operatorname{sen}\alpha = \frac{1}{\sqrt{5}}\ ;\ \cos\alpha = \frac{2}{\sqrt{5}}$

$\vec{v}_D = \vec{v}_C + \vec{v}_{D/C}$

$? \ \alpha \qquad \downarrow \qquad |\ ?$

$\qquad \vec{v}_B + \vec{v}_{C/B}$

$\qquad \downarrow \omega L \qquad 45° \ \omega_{BC}\sqrt{2}L = \sqrt{2}\omega L$



$v_D \operatorname{sen}\alpha = \omega L \Rightarrow v_D = \frac{\omega L}{\operatorname{sen}\alpha} = \sqrt{5}\,\omega L = \omega_{DE}\frac{\sqrt{5}}{2}L \Rightarrow$

$\boxed{\omega_{DE} = 2\omega \ \text{entr}}$

$v_{D/C} = v_D\cos\alpha = \sqrt{5}\,\omega L\frac{2}{\sqrt{5}} = 2\omega L = \omega_{CD}L \Rightarrow \boxed{\omega_{CD} = 2\omega \ \text{sai}}$

d, e) $\vec{a}_F = \vec{a}_a + \vec{a}_r + \vec{a}_{cor} \quad (BC)$

$\quad \| \qquad \downarrow \qquad ?\ \angle 45° \qquad \hookrightarrow$

$\quad \vec{0} \qquad \vec{a}_B + \vec{a}_{F/B}$

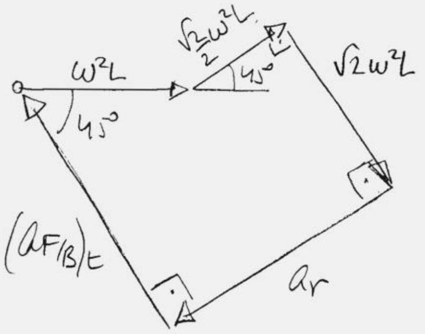
$\qquad \xrightarrow[\omega^2 L]{} \qquad n \quad t$

n: $\angle 45°$ $\quad \omega_{BC}^2\frac{\sqrt{2}}{2}L = \frac{\sqrt{2}}{2}\omega^2 L$

t: $45° \ ?$

$2\,\omega_{BC}\wedge v_r = 2\omega\frac{\sqrt{2}}{2}\omega L = \angle 45°$

$= \sqrt{2}\,\omega^2 L \quad 45°$



$$\boxed{a_r} = \frac{\sqrt{2}}{2}\omega^2 L + \frac{\sqrt{2}}{2}\omega^2 L =$$

$$\boxed{= \sqrt{2}\,\omega^2 L \quad 45°}$$

$$(a_{F/B})_t = \sqrt{2}\omega^2 L + \frac{\sqrt{2}}{2}\omega^2 L =$$

$$= \frac{3\sqrt{2}}{2}\omega^2 L = \alpha_{BC}\frac{\sqrt{2}}{2}L \Rightarrow$$

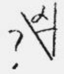
$$\boxed{\alpha_{BC} = 3\omega^2 \text{ entr}}$$

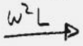
$$\vec{a}_D = \vec{a}_C + \vec{a}_{D/C} \begin{cases} n & \leftarrow \omega_{CD}^2 L = 4\omega^2 L \\ t & |\ ? \end{cases}$$

$\vec{a}_D$: n, t

$\vec{a}_C \rightsquigarrow \vec{a}_B + \vec{a}_{C/B}$

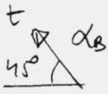
$\omega_{DE}^2 \frac{\sqrt{5}}{2}L = 2\sqrt{5}\,\omega^2 L$



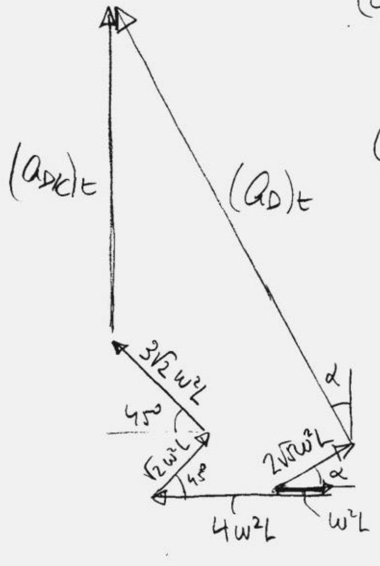


$\vec{a}_{C/B}$: n, t

$\omega_{BC}^2\sqrt{2}L = \sqrt{2}\,\omega^2 L$



$\alpha_{BC}\sqrt{2}L = 3\sqrt{2}\,\omega^2 L$



$$(a_D)_t \operatorname{sen}\alpha = 2\sqrt{5}\omega^2 L\cos\alpha + 3\omega^2 L -$$

$$\sqrt{2}\,\omega^2 L\frac{\sqrt{2}}{2} + 3\sqrt{2}\,\omega^2 L\frac{\sqrt{2}}{2} \Rightarrow$$

$$(a_D)_t\frac{1}{\sqrt{5}} = 2\sqrt{5}\omega^2 L\frac{2}{\sqrt{5}} + 5\omega^2 L = 9\omega^2 L$$

$$(a_D)_t = 9\sqrt{5}\,\omega^2 L = \alpha_{DE}\frac{\sqrt{5}}{2}L \Rightarrow \boxed{\alpha_{DE} = 18\omega^2 \text{ entr}}$$

$$(a_{D/C})_t + 3\sqrt{2}\omega^2 L\frac{\sqrt{2}}{2} + \sqrt{2}\omega^2 L\frac{\sqrt{2}}{2} =$$

$$= (a_D)_t\cos\alpha + 2\sqrt{5}\,\omega^2 L\operatorname{sen}\alpha$$

$$(a_{D/C})_t = 16\,\omega^2 L = \alpha_{CD}L \Rightarrow \boxed{\alpha_{CD} = 16\omega^2 \text{ hor}}$$