Kinematics

Engineering Mechanics: Dynamics

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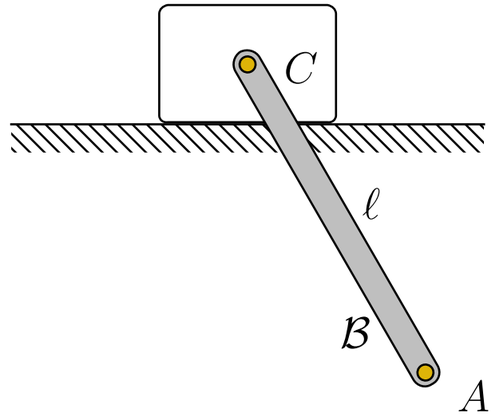
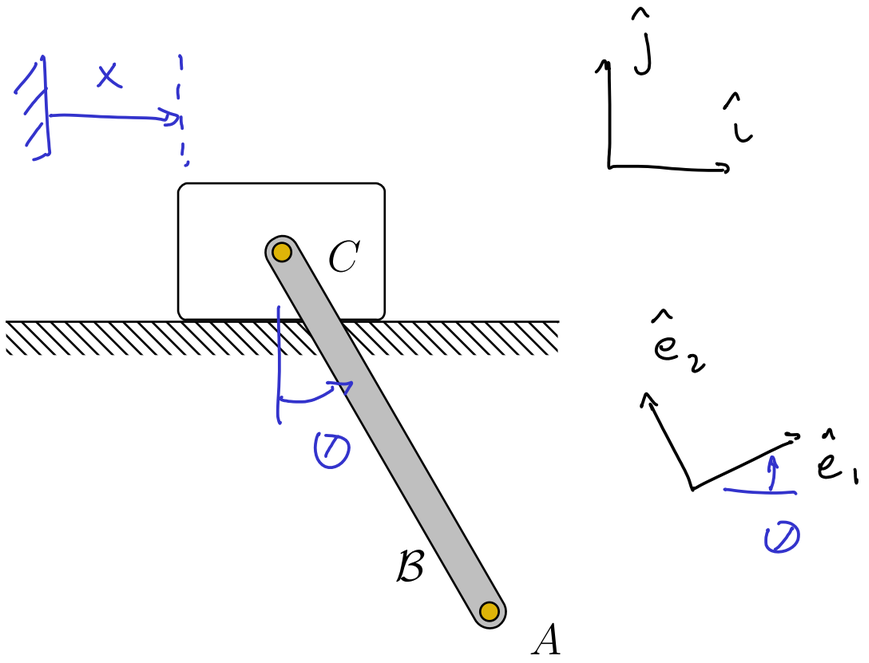
The block slides to the right with speed v while the bar of length ℓ is pinned to the block at C rotates clockwise with angular speed ω. Find the velocity of A at the end of the bar.





$$\hat{e}_1 = C_\theta \hat{\imath} + S_\theta \hat{\jmath}$$

$$\hat{e}_2 = -S_\theta \hat{\imath} + C_\theta \hat{\jmath}$$

$$\hat{\imath} = C_\theta \hat{e}_1 - S_\theta \hat{e}_2$$

$$\hat{\jmath} = S_\theta \hat{e}_1 + C_\theta \hat{e}_2$$

$$\underline{v}_C = \dot{x}\hat{\imath} = v\hat{\imath}$$

$$\underline{\omega}_\beta = \dot{\theta}\hat{k} = -\omega\hat{k}$$

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A & C ARE FIXED IN THE BAR

$$\underline{v}_A = \underline{v}_C + \underline{\omega}_\beta \times \underline{r}_{A/C}$$

$\underline{v}_C = v\hat{\imath}$

$\underline{\omega}_\beta = -\omega\hat{k}$

$\underline{r}_{A/C} = -l\hat{e}_2$

SO THAT

$$\underline{v}_A = v\hat{\imath} + (-\omega\hat{k}) \times (-l\hat{e}_2)$$

$$= v\hat{\imath} - l\omega\hat{e}_1 = (v - l\omega C_\theta)\hat{\imath} + (-l\omega S_\theta)\hat{\jmath}$$

MOTION OF BLOCK

ROTATION OF BAR

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