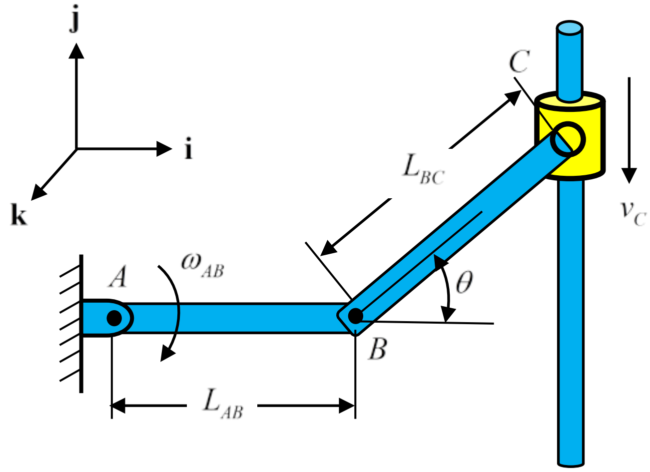
3-5. The block $C$ is moving downward with a normally distributed velocity $v_C \sim N(3, 0.3^2)$ m/s. The lengths of two bars are $L_{AB} = 2$ m and $L_{BC} = 3$ m, respectively. If $\theta = 30^\circ$, determine the angular velocity of bar $AB$ at the instant shown.




$$\mathbf{r}_{C/B} = L_{BC}\cos\theta\mathbf{i} + L_{BC}\sin\theta\mathbf{j}$$

$$\mathbf{v}_C = \mathbf{v}_B + \boldsymbol{\omega}_{BC} \times \mathbf{r}_{C/B}$$

$$\begin{aligned} -v_C\mathbf{j} &= -\omega_{AB}L_{AB}\mathbf{j} + \omega_{BC}\mathbf{k} \times (L_{BC}\cos\theta\mathbf{i} + L_{BC}\sin\theta\mathbf{j}) \\ &= -\omega_{AB}L_{AB}\mathbf{j} + \omega_{BC}L_{BC}\cos\theta\mathbf{j} - \omega_{BC}L_{BC}\sin\theta\mathbf{i} \end{aligned}$$

Equating $\mathbf{i}$ and $\mathbf{j}$ components gives

$$\omega_{BC}L_{BC}\sin\theta = 0, \ \omega_{BC} = 0$$

$$-v_C = -\omega_{AB}L_{AB} + \omega_{BC}L_{BC}\cos\theta$$

$$\omega_{AB} = \frac{v_C}{L_{AB}}$$

$$\mu_{\omega_{AB}} = \frac{\mu_{v_C}}{L_{AB}} = \frac{3}{2} = 1.5 \text{ rad/s}$$

$$\sigma_{\omega_{AB}} = \frac{\sigma_{v_C}}{L_{AB}} = \frac{0.3}{2} = 0.15 \text{ rad/s}$$

Therefore, $\omega_{AB} \sim N(1.5, 0.15^2)$ rad/s. **Ans.**