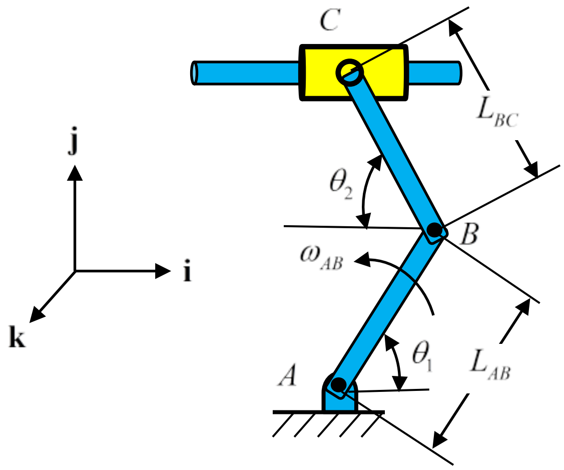
3-7. Bar *AB* rotates with a normally distributed angular velocity $\omega_{AB} \sim N(2, 0.2^2)$ rad/s. The lengths of the two bars are $L_{AB} = 1$ m and $L_{BC} = 1.2$ m, respectively. If $\theta_1 = 45^\circ$ and $\theta_2 = 60^\circ$, determine the velocity of the slider block *C*.



$$\mathbf{r}_{C/B} = -L_{BC}\cos\theta_2\mathbf{i} + L_{BC}\sin\theta_2\mathbf{j}$$

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

$$\begin{aligned} -v_C\mathbf{i} &= -\omega_{AB}L_{AB}\sin\theta_1\mathbf{i} + \omega_{AB}L_{AB}\cos\theta_1\mathbf{j} + \omega_{BC}\mathbf{k} \times (-L_{BC}\cos\theta_2\mathbf{i} + L_{BC}\sin\theta_2\mathbf{j}) \\ &= -\omega_{AB}L_{AB}\sin\theta_1\mathbf{i} + \omega_{AB}L_{AB}\cos\theta_1\mathbf{j} - \omega_{BC}L_{BC}\cos\theta_2\mathbf{j} - \omega_{BC}L_{BC}\sin\theta_2\mathbf{i} \end{aligned}$$

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

$$\mathbf{j}: \ \omega_{AB}L_{AB}\cos\theta_1 - \omega_{BC}L_{BC}\cos\theta_2 = 0$$

$$\omega_{BC} = \frac{\omega_{AB}L_{AB}\cos\theta_1}{L_{BC}\cos\theta_2}$$

$$\begin{aligned} \mathbf{i}: \ v_C &= \omega_{AB}L_{AB}\sin\theta_1 + \omega_{BC}L_{BC}\sin\theta_2 \\ &= \omega_{AB}L_{AB}(\sin\theta_1 + \cos\theta_1\tan\theta_2) \end{aligned}$$

$$\mu_{v_C} = \mu_{\omega_{AB}}L_{AB}(\sin\theta_1 + \cos\theta_1\tan\theta_2) = 2(1)(\sin 45^\circ + \cos 45^\circ \tan 60^\circ) = 3.86 \text{ m/s}$$

$$\sigma_{v_C} = \sigma_{\omega_{AB}}L_{AB}(\sin\theta_1 + \cos\theta_1\tan\theta_2) = 0.2(1)(\sin 45^\circ + \cos 45^\circ \tan 60^\circ) = 0.39 \text{ m/s}$$

Therefore, $v_C \sim N(3.86, 0.39^2)$ m/s. **Ans.**