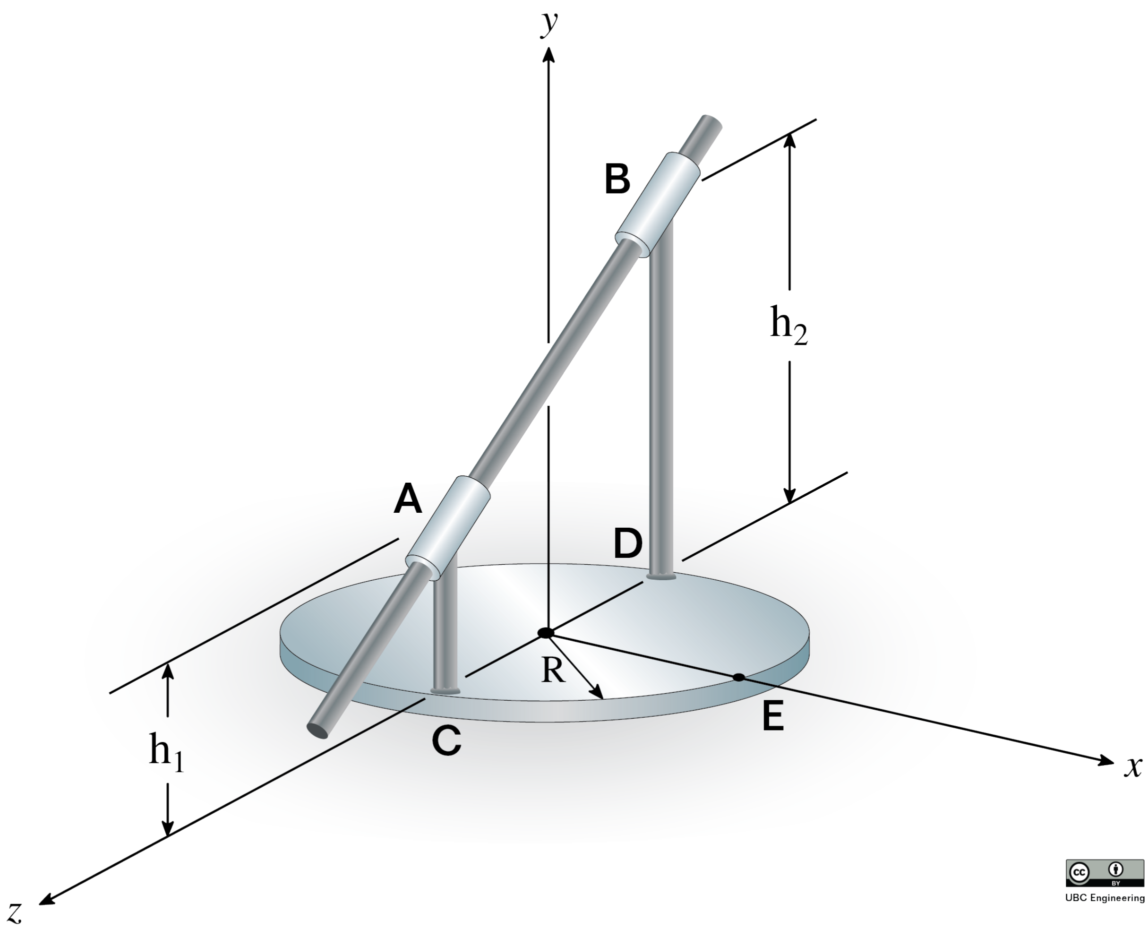

In the figure shown, the circular plate of radius $R = 0.15$m rotates about the rod joining points A and B, with a constant angular velocity $\omega = 0.2$rad/s. The velocity of point C is, at this instant, in the positive x direction. $h_1 = 0.1$m, $h_2 = 0.3$m

Determine the velocity and acceleration of point E(R,0,0). Enter the components of each below:

$v_{E,x} =$

$v_{E,y} =$

$v_{E,z} =$

$a_{E,x} =$

$a_{E,y} =$

$a_{E,z} =$

Solution:

$$\vec{BA} = (h_1 - h_2)\hat{j} + (2R)\hat{k} \qquad BA = \sqrt{(h_1 - h_2)^2 + 4R^2} \implies \hat{u}_{BA} = \frac{\vec{BA}}{BA}$$

Using this, we find that the angular velocity is $\omega = \omega\hat{u}_{BA}$. E relative to A is $\vec{r}_{E/A} = R\hat{i} - h_1\hat{j} - R\hat{k}$, and so the velocity and acceleration at E is:

$$\vec{v}_E = \vec{\omega} \times \vec{r}_{E/A} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & \omega_j & \omega_k \\ R & -h_1 & -R \end{vmatrix}$$

$$= (-R\omega_j + h_1\omega_k)\hat{i} + (R\omega_k)\hat{j} + (-R\omega_j)\hat{k}$$

$$\vec{a}_E = \vec{\omega} \times \vec{v}_B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & \omega_j & \omega_k \\ (-R\omega_j + h_1\omega_k) & (R\omega_k) & (-R\omega_j) \end{vmatrix}$$

$$= (-R\omega_j^2 - R\omega_k^2)\hat{i} + (\omega_k(-R\omega_j + h_1\omega_k))\hat{j} - (\omega_j(-R\omega_j + h_1\omega_k))\hat{k}$$