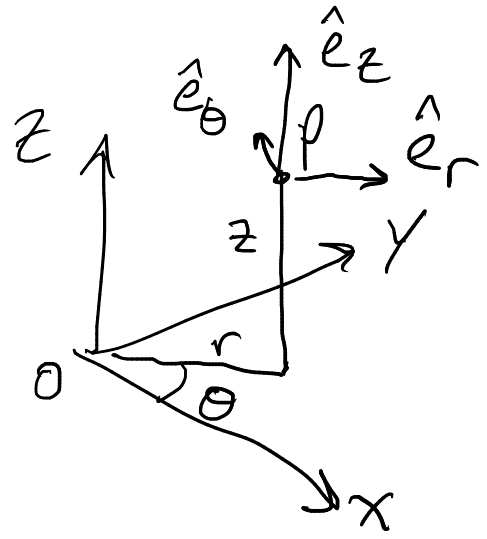
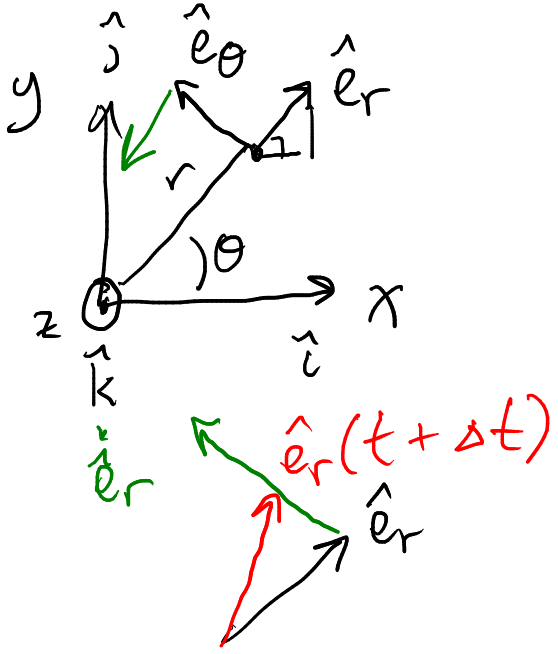
iclicker grades are uploaded! "Lectures" L3/L4

Reports and worksheets → returned in discussion.

Cylindrical Coordinates





$$x = r\cos\theta$$

$$y = r\sin\theta$$

$$z = z$$

$$\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$$

$$\hat{e}_\theta = -\sin\theta\,\hat{i} + \cos\theta\,\hat{j}$$

$$\frac{d}{dt} \rightarrow \dot{\hat{e}}_r = \frac{d}{dt}\hat{e}_r = \frac{d}{d\theta}\hat{e}_r\frac{d\theta}{dt}$$

$$= -\sin\theta\,\dot{\theta}\,\hat{i} + \cos\theta\,\dot{\theta}\,\hat{j}$$

$$= \dot{\theta}(-\sin\theta\,\hat{i} + \cos\theta\,\hat{j})$$

$$= \dot{\theta}\,\hat{e}_\theta \leftarrow \perp \hat{e}_r$$

$$\dot{\hat{e}}_\theta = -\dot{\theta}\,\hat{e}_r$$

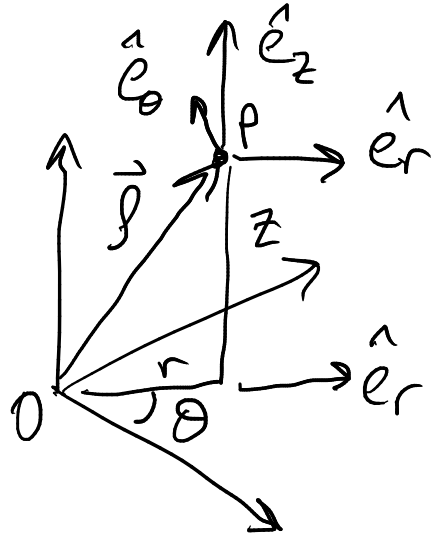
$$\dot{\hat{e}}_r = \dot{\theta}\,\hat{e}_\theta$$

$$\dot{\hat{e}}_\theta = -\dot{\theta}\,\hat{e}_r$$

$$\vec{\rho} = \overrightarrow{OP}$$

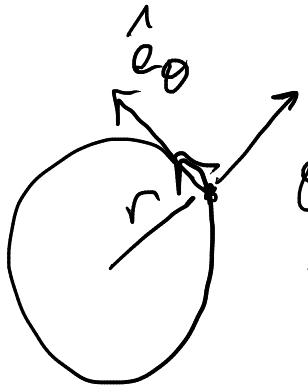
$$\vec{\rho} = r\hat{e}_r + z\hat{e}_z$$

$\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$



$$\dot{\vec{\rho}} = \dot{r}\,\hat{e}_r + r\dot{\hat{e}}_r + \dot{z}\,\hat{e}_z + z\dot{\hat{e}}_z$$

$$\vec{v}_p = \boxed{\dot{\vec{\rho}} = \dot{r}\,\hat{e}_r + r\dot{\theta}\,\hat{e}_\theta + \dot{z}\,\hat{e}_z}$$



$\dot{\theta} = \omega = \text{constant}$

$r = \text{constant}$

$z = \text{constant}$

$$\vec{v}_p = \dot{\vec{\rho}} = r\omega\,\hat{e}_\theta$$