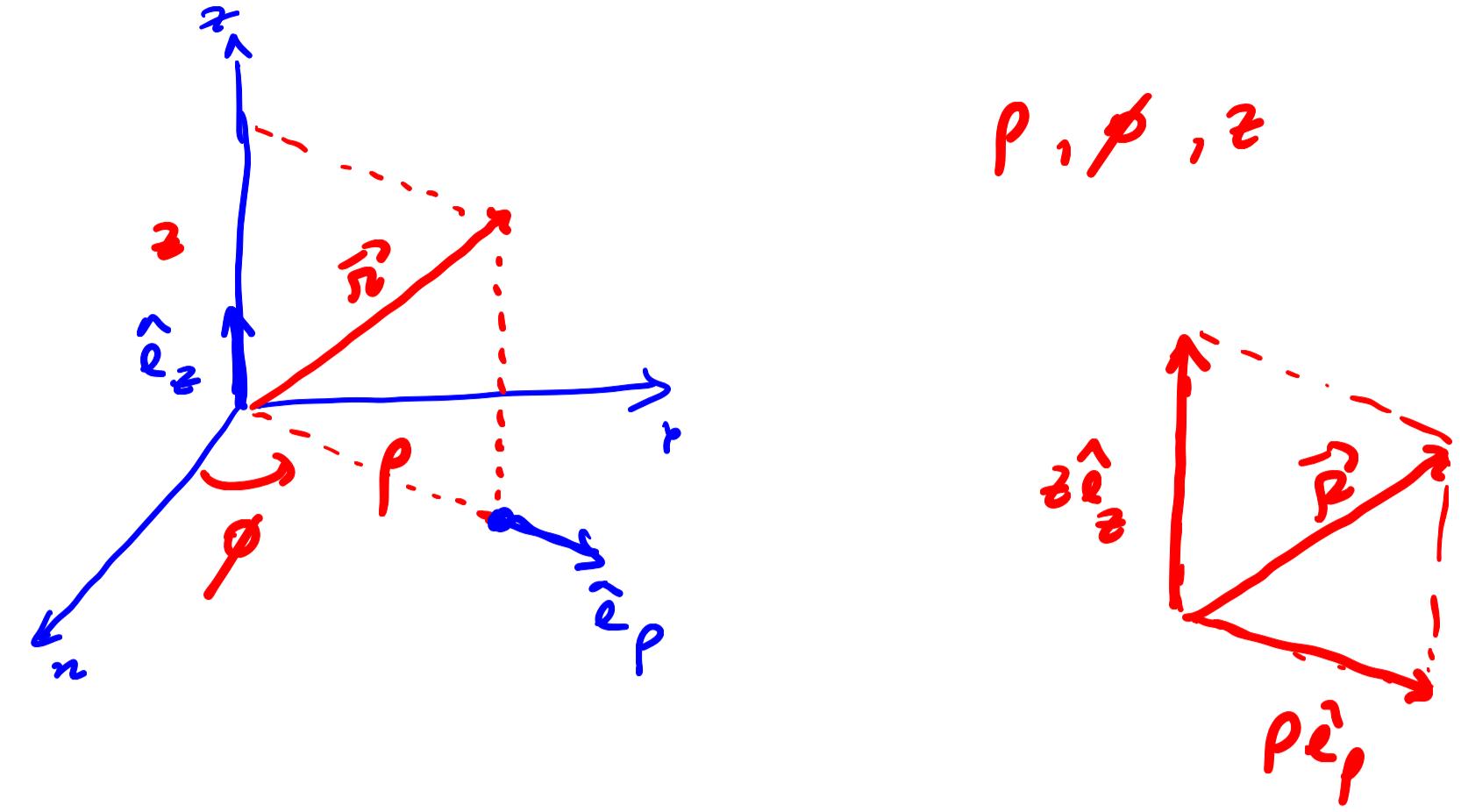


Vector position na base das coord. cilíndricas



$$\vec{r} = \rho \hat{e}_\rho + 0 \hat{e}_\phi + z \hat{e}_z$$

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{A} \cdot \hat{i} = A_x \hat{i} \cdot \hat{i} + A_y \hat{j} \cdot \hat{i} + A_z \hat{k} \cdot \hat{i}$$

$$\vec{A} \cdot \hat{i} = A_x; \quad \vec{A} \cdot \hat{j} = A_y; \quad \vec{A} \cdot \hat{k} = A_z$$

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$= (\vec{A} \cdot \hat{i}) \hat{i} + (\vec{A} \cdot \hat{j}) \hat{j} + (\vec{A} \cdot \hat{k}) \hat{k}$$

$$\vec{A} = A_\rho \hat{e}_\rho + A_\phi \hat{e}_\phi + A_z \hat{e}_z$$

$$= (\vec{A} \cdot \hat{e}_\rho) \hat{e}_\rho + (\vec{A} \cdot \hat{e}_\phi) \hat{e}_\phi + (\vec{A} \cdot \hat{e}_z) \hat{e}_z$$

$$\begin{aligned} \hat{e}_\rho &= (\cos \phi) \hat{i} + (\sin \phi) \hat{j} + 0 \hat{k} \\ &= (\hat{e}_\rho \cdot \hat{i}) \hat{i} + (\hat{e}_\rho \cdot \hat{j}) \hat{j} + (\hat{e}_\rho \cdot \hat{k}) \hat{k} \end{aligned}$$

Campo vetorial: $\vec{v} = (\alpha + 1) \hat{i} + \hat{j} + \gamma \hat{k}$

Base das coord. cartesianas:

$$\begin{aligned} x &= r \cos \theta \cos \phi \\ y &= r \cos \theta \sin \phi \\ z &= r \sin \theta \end{aligned} \quad \left| \begin{array}{l} \hat{e}_x = \sin \theta \cos \phi \hat{i} + \sin \theta \sin \phi \hat{j} + \cos \theta \hat{k} \\ \hat{e}_y = \cos \theta \cos \phi \hat{i} + \cos \theta \sin \phi \hat{j} - \sin \theta \hat{k} \\ \hat{e}_z = -\sin \phi \hat{i} + \cos \phi \hat{j} + 0 \hat{k} \end{array} \right.$$

$$\left| \begin{array}{l} \hat{i} = \sin \theta \cos \phi \hat{e}_x + \sin \theta \sin \phi \hat{e}_y - \cos \theta \hat{e}_z \\ \hat{j} = \cos \theta \cos \phi \hat{e}_x + \cos \theta \sin \phi \hat{e}_y + \sin \theta \hat{e}_z \\ \hat{k} = -\sin \phi \hat{e}_x - \cos \phi \hat{e}_y + 0 \hat{e}_z \end{array} \right.$$

Então:

$$1^{\text{º}} \text{ passo: } \vec{v} = (r \cos \theta \cos \phi + 1) \hat{i} + \hat{j} + r \sin \theta \sin \phi \hat{k}$$

$$2^{\text{º}} \text{ passo: } = (r \cos \theta \cos \phi + 1) (\sin \theta \cos \phi \hat{e}_x + \sin \theta \sin \phi \hat{e}_y - \cos \theta \hat{e}_z) \\ + \quad \quad \quad (r \cos \theta \sin \phi \hat{e}_x + r \sin \theta \hat{e}_y + 0 \hat{e}_z) \\ + r \sin \theta \sin \phi (0 \hat{e}_x - \sin \theta \hat{e}_y + 0 \hat{e}_z)$$

$$3^{\text{º}} \text{ passo: } = \left[r \sin^2 \theta \cos^2 \phi + \sin \theta \cos \phi + \sin \theta \sin \phi + r \cos \theta \sin \phi \right] \frac{\hat{e}_x}{\hat{e}_\rho} \\ + \left[-r \sin \theta \cos \phi \sin \phi + \cos \phi \right] \hat{e}_\phi$$