

Análisis vectorial

$$\begin{aligned}\nabla \times \mathbf{f} &= \frac{1}{r^2 \operatorname{sen} \theta} \begin{vmatrix} \mathbf{e}_r & r\mathbf{e}_\theta & r \operatorname{sen} \theta \mathbf{e}_\phi \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial \theta} & \frac{\partial}{\partial \phi} \\ f_r & rf_\theta & r \operatorname{sen} \theta f_\phi \end{vmatrix} \\ &= \frac{1}{r \operatorname{sen} \theta} \left[\frac{\partial}{\partial \theta} (\operatorname{sen} \theta f_\phi) - \frac{\partial f_\theta}{\partial \phi} \right] \mathbf{e}_r + \frac{1}{r} \left[\frac{1}{\operatorname{sen} \theta} \frac{\partial f_r}{\partial \phi} - \frac{\partial}{\partial r} (rf_\phi) \right] \mathbf{e}_\theta + \frac{1}{r} \left[\frac{\partial}{\partial r} (rf_\theta) - \frac{\partial f_r}{\partial \theta} \right] \mathbf{e}_\phi\end{aligned}$$