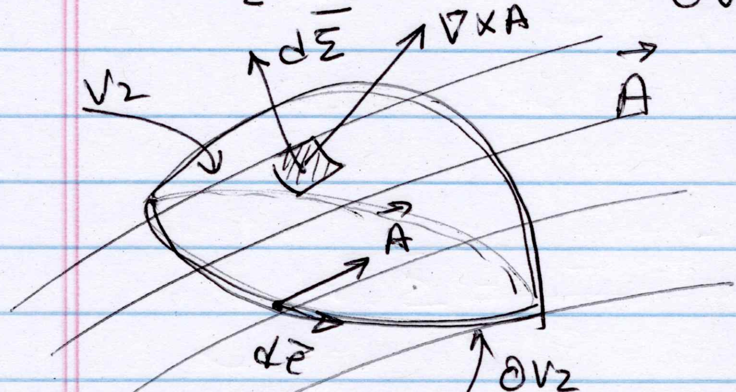
Modern Classical Physics
(Thorne & Blandford) —

Exercise 1.12 : Faraday's law of induction.

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

Stokes' theorem :

$$\int_{V_2} \nabla \times \vec{A} \cdot d\vec{\Sigma} = \int_{\partial V_2} \vec{A} \cdot d\vec{\ell}$$



circulation of $\vec{A}$ along ∂V_2 is equal to the flux of $\nabla \times \vec{A}$ accross the surface V_2.

Integrating Faraday's law :

$$\int_{V_2} \nabla \times \vec{E} \cdot d\vec{\Sigma} = -\int_{V_2} \frac{\partial \vec{B}}{\partial t} \cdot d\vec{\Sigma}$$

$$\underbrace{\int_{\partial V_2} \vec{E} \cdot d\vec{\ell}}_{\substack{\text{circulation of } \vec{E} \\ \text{along } \partial V_2 \\ \text{(e.m.f.)}}} = \underbrace{-\frac{\partial}{\partial t} \underbrace{\int_{V_2} \vec{B} \cdot d\vec{\Sigma}}_{\text{flux of } \vec{B} \text{ accross } V_2}}_{\text{Rate of change of flux of } \vec{B} \text{ accross } V_2}$$

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