Faraday's Law

The integral form of Faraday's law of induction is written as:

$$\frac{d}{dt}\left(\iint \boldsymbol{B} \cdot d\boldsymbol{A}\right) = -\oint \boldsymbol{E} \cdot d\boldsymbol{s}$$

By Stokes' theorem:

$$-\oint \boldsymbol{E} \cdot d\boldsymbol{s} = -\iint curl\ \boldsymbol{E} \cdot d\boldsymbol{A}$$

Therefore,

$$-\iint curl\ \boldsymbol{E} \cdot d\boldsymbol{A} = \frac{d}{dt}\left(\iint \boldsymbol{B} \cdot d\boldsymbol{A}\right)$$

$$-\iint curl\ \boldsymbol{E} \cdot d\boldsymbol{A} = \left(\iint \frac{\boldsymbol{\partial B}}{\boldsymbol{\partial t}} \cdot d\boldsymbol{A}\right)$$

Which simplifies to

$$\text{curl } \mathbf{E} = -\frac{\boldsymbol{\partial B}}{\boldsymbol{\partial t}}$$

Faraday's law of induction in differential form