Maxwell Equations

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Scalar and vector field

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Scalar field

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Vector field

If to each position $x = (x_1, x_2, x_3)$ of a region in space, it corresponds a vector $\vec{a}(x_1, x_2, x_3)$, then $\vec{a}$ is called a *vector field*. Like *velocity* field.

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How does scalar or vector field change along spatial dimensions?

Nabla operator ∇

Partial derivatives is an useful tool to measure the changes along spatial dimensions.
For scalar field

$$\partial_i \phi = \frac{\partial}{\partial x_i} \phi \tag{1}$$

For vector field

$$(\partial_i \vec{a})(\vec{r}) = \lim_{\Delta x_i \to 0} \frac{\vec{a}(\vec{r} + \Delta x_i \vec{e}_i) - \vec{a}(\vec{r})}{\Delta x_i} \tag{2}$$

To simplify the partial derivatives, we imply *Nabla operator*.

Nabla operator

$$\nabla(\cdot) = \sum_i \vec{e}_i \partial_i (\cdot) \tag{3}$$

Gradient, diverence, curl

Gradient

$$grad\phi = \nabla\phi = \sum_i \vec{e}_i \partial_i \phi \tag{4}$$

Divergence

$$(div\vec{a}) = (\nabla\vec{a}) = \sum_i (\partial_i \vec{a}) \tag{5}$$

Curl

$$curl\vec{a} = \nabla \times \vec{a} = det \begin{pmatrix} \vec{e}_1 & \vec{e}_1 & \vec{e}_1 \\ \partial_1 & \partial_1 & \partial_1 \\ \vec{a}_1 & \vec{a}_1 & \vec{a}_1 \end{pmatrix} \tag{6}$$

Definition

Forward process

Backward process

Formulation

Solution

Items

- Text visible on slide 1

Items

- Text visible on slide 1
- Text visible on slide 2

Items

- Text visible on slide 1
- Text visible on slide 2
- Text visible on slide 3

Items

- Text visible on slide 1
- Text visible on slide 2

- Text visible on slide 4

Pause

In this slide

Pause

In this slide the text will be partially visible

Pause

In this slide the text will be partially visible And finally everything will be there

Sample frame title

In this slide, some important text will be highlighted because it's important. Please, don't abuse it.

Remark

Sample text

Important theorem

Sample text in red box

Examples

Sample text in green box. The title of the block is "Examples".

Two-column slide

This is a text in first column.

$$E = mc^2$$

- First item
- Second item

This text will be in the second column and on a second through this is a nice looking layout in some cases.