E&M 101

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November 5, 2018

Abstract

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I. Basic Math

$\nabla \times F$	$\begin{bmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2n} \\ \hdotsfor{5} \\ x_{d1} & x_{d2} & x_{d3} & \cdots & x_{dn} \end{bmatrix}$
Ampere's Law	$\boldsymbol{\nabla} \times \boldsymbol{H} = \boldsymbol{J_s} + \frac{\partial D}{\partial t}$
Gauss' Law, Electric	$\boldsymbol{\nabla} \cdot \boldsymbol{D} = \boldsymbol{\rho}$
Gauss' Law, Magnetic	$\boldsymbol{\nabla} \cdot \boldsymbol{B} = 0$
Equation of continuity	$\boldsymbol{\nabla} \cdot \boldsymbol{J_s} = -\frac{\partial \rho}{\partial t}$

i. Variables

II. Maxwell' Equations

i. Differential Form

	Differential Form
Faraday's Law	$\boldsymbol{\nabla} \times \boldsymbol{E} = -\frac{\partial B}{\partial t}$
Ampere's Law	$\boldsymbol{\nabla} \times \boldsymbol{H} = \boldsymbol{J_s} + \frac{\partial D}{\partial t}$
Gauss' Law, Electric	$\boldsymbol{\nabla} \cdot \boldsymbol{D} = \boldsymbol{\rho}$
Gauss' Law, Magnetic	$\boldsymbol{\nabla} \cdot \boldsymbol{B} = 0$
Equation of continuity	$\boldsymbol{\nabla} \cdot \boldsymbol{J_s} = -\frac{\partial \rho}{\partial t}$

*A thank you or further information

ii. Variables

These equations are for **time varying** Electro-Magnetic fields.

$\boldsymbol{E}(\boldsymbol{r}, t)$ is the electric field intensity (V/m)
$\boldsymbol{M}(\boldsymbol{r}, t)$ is the magnetic field intensity (A/m)
$\boldsymbol{D}(\boldsymbol{r}, t)$ is the electric flux density (C/m)
$\boldsymbol{B}(\boldsymbol{r}, t)$ is the magnetic flux density (Wb/m)
$\boldsymbol{J_s}(\boldsymbol{r}, t)$ is the "impressed" electric surface current density ($\frac{A}{m^2}$)
$\boldsymbol{B}(\boldsymbol{r}, t)$ is the magnetic flux density ($\frac{C}{m^3}$)
$v_g = \frac{\partial \omega}{\partial k} = \frac{c}{n} - \frac{ck}{n^2}\frac{\partial n}{\partial k}$
if the refractive index is constant (not a function of frequency or subsequentally wavelength), $\frac{\partial n}{\partial k} = 0$ and consequentially $\sin(\frac{w\Delta t}{2}) = \pm\frac{c\Delta t}{\Delta x}\sin(\frac{\bar{k}\Delta x}{2})$ note: if $c\Delta t = \Delta x$ aka your discrete time interval / discrete position interval = c, you will have no disperion error. Otherwise your system will have a rolling inaccuracy (i.e. $\frac{\Delta x}{\Delta t} =< c$) and compound the error as the wave propagates. This gives rise to the idea of

a **magic time step**

$$\Delta t = \frac{c}{\Delta x}$$

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III. Methods

IV. Discussion

i. Subsection One

ii. Subsection Two

References

[Figueredo and Wolf, 2009] Figueredo, A. J. and Wolf, P. S. A. (2009). Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330.

V. Equations