Songs to Solve Electrodynamics to

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Recepção Tensorial 2019

Blank Space
Taylor Swift

All Star - Smash Mouth

$$\begin{cases} \nabla \cdot \mathbf{E} = \dfrac{\rho}{\epsilon_0} \\ \nabla \times \mathbf{E} = \mathbf{0} \end{cases}$$

$$\Downarrow$$

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \int \frac{\rho}{\boldsymbol{\mathscr{r}}^2} \hat{\boldsymbol{\mathscr{r}}} \, \mathrm{d}\tau'$$

$$\begin{cases} \nabla \cdot \mathbf{B} = 0 \\ \nabla \times \mathbf{B} = \mu_0 \mathbf{J} \end{cases}$$

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$$\mathbf{B} = \frac{\mu_0}{4\pi} \int \frac{\mathbf{J} \times \boldsymbol{\mathscr{r}}}{\boldsymbol{\mathscr{r}}^2} \, \mathrm{d}\tau'$$

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Treat You Better - Shawn Mendes

$$\boldsymbol{\nabla} \times \mathbf{E} = \mathbf{0} \qquad\qquad \nabla \cdot \mathbf{B} = 0$$

$$\Downarrow \qquad\qquad \Downarrow$$

$$\mathbf{E} = -\boldsymbol{\nabla} V \qquad\qquad \mathbf{B} = \boldsymbol{\nabla} \times \mathbf{A}$$

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$$\nabla^2 V = -\frac{\rho}{\epsilon_0} \qquad\qquad \nabla^2 \mathbf{A} = -\mu_0 \mathbf{J}$$

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Live While We're Young - One Direction

$$\begin{cases} \partial_\nu F^{\mu\nu} = \mu_0 J^\mu \\ \partial_\nu G^{\mu\nu} = 0 \end{cases}$$

Take On Me - a-ha

$$\begin{cases} \nabla \cdot \mathbf{E} = \dfrac{\rho}{\epsilon_0} \\ \nabla \cdot \mathbf{B} = 0 \\ \nabla \times \mathbf{E} = -\dfrac{\partial \mathbf{B}}{\partial t} \\ \nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \dfrac{\partial \mathbf{E}}{\partial t} \end{cases}$$

One of Us - Joan Osborne

$$\nabla \cdot \mathbf{B} = 0$$

$$\Downarrow$$

$$\mathbf{B} = \nabla \times \mathbf{A}$$

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

$$\Downarrow$$

$$\nabla \times \left(\mathbf{E} + \frac{\partial \mathbf{A}}{\partial t} \right) = \mathbf{0}$$

$$\Downarrow$$

$$\mathbf{E} + \frac{\partial \mathbf{A}}{\partial t} = -\nabla V$$

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Superman (It's Not Easy) - Five for Fighting

$$\nabla^2 V + \frac{\partial}{\partial t}\left(\boldsymbol{\nabla}\cdot\mathbf{A}\right) = -\frac{\rho}{\epsilon_0}$$

$$\left(\nabla^2\mathbf{A} - \mu_0\epsilon_0\frac{\partial^2\mathbf{A}}{\partial t^2}\right) - \boldsymbol{\nabla}\left(\boldsymbol{\nabla}\cdot\mathbf{A} + \mu_0\epsilon_0\frac{\partial V}{\partial t}\right) = -\mu_0\mathbf{J}$$

Somebody That I Used To Know - Gotye, Kimbra

$$\nabla^2 V - \frac{1}{c^2}\frac{\partial^2 V}{\partial t^2} = -\frac{\rho}{\epsilon_0}$$
$$\nabla^2 \mathbf{A} - \frac{1}{c^2}\frac{\partial^2 \mathbf{A}}{\partial t^2} = -\mu_0 \mathbf{J}$$

Somebody That I Used To Know - Gotye, Kimbra

$$\nabla^2 V - \frac{1}{\infty}\frac{\partial^2 V}{\partial t^2} = -\frac{\rho}{\epsilon_0}$$

$$\nabla^2 \mathbf{A} - \frac{1}{\infty}\frac{\partial^2 \mathbf{A}}{\partial t^2} = -\mu_0 \mathbf{J}$$

Somebody That I Used To Know - Gotye, Kimbra

$$\nabla^2 V = -\frac{\rho}{\epsilon_0}$$

$$\nabla^2 \mathbf{A} = -\mu_0 \mathbf{J}$$

Feel So Close - Calvin Harris

$$V(\mathbf{r},t) = \frac{1}{4\pi\epsilon_0}\int \frac{\rho(\mathbf{r}',t)}{\mathscr{r}}\,\mathrm{d}\tau'$$

$$\mathbf{A}(\mathbf{r},t) = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}(\mathbf{r}',t)}{\mathscr{r}}\,\mathrm{d}\tau'$$

Feel So Close - Calvin Harris

$$V(\mathbf{r}, t) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\mathbf{r}', t - \frac{\mathcal{r}}{c})}{\mathcal{r}} \, \mathrm{d}\tau'$$

$$\mathbf{A}(\mathbf{r}, t) = \frac{\mu_0}{4\pi} \int \frac{\mathbf{J}(\mathbf{r}', t - \frac{\mathcal{r}}{c})}{\mathcal{r}} \, \mathrm{d}\tau'$$

Best Day Of My Life - American Authors

$$\mathbf{E}(\mathbf{r},t) = -\boldsymbol{\nabla} V - \frac{\partial \mathbf{A}}{\partial t}$$

$$\mathbf{B}(\mathbf{r},t) = \boldsymbol{\nabla} \times \mathbf{A}$$

Best Day Of My Life - American Authors

$$\mathbf{E}(\mathbf{r},t) = \frac{1}{4\pi\epsilon_0}\int \frac{\hat{\boldsymbol{\mathscr{r}}}}{\mathscr{r}^2}\lfloor\rho\rfloor + \frac{\hat{\boldsymbol{\mathscr{r}}}}{c\,\mathscr{r}}\left\lfloor\frac{\partial\rho}{\partial t}\right\rfloor - \frac{1}{c^2\,\mathscr{r}}\left\lfloor\frac{\partial\mathbf{J}}{\partial t}\right\rfloor \mathrm{d}\tau'$$

$$\mathbf{B}(\mathbf{r},t) = \frac{\mu_0}{4\pi}\int \left[\frac{1}{\mathscr{r}^2}\lfloor\mathbf{J}\rfloor + \frac{1}{c\,\mathscr{r}}\left\lfloor\frac{\partial\mathbf{J}}{\partial t}\right\rfloor\right] \times \hat{\boldsymbol{\mathscr{r}}}\,\mathrm{d}\tau'$$

A Cruel Angel's Thesis
Yoko Takahashi

Deja Vu (Initial D) - Tsuko G

$$\begin{cases} \nabla \cdot \mathbf{D} = \rho \\ \nabla \cdot \mathbf{B} = 0 \\ \nabla \times \mathbf{E} = -\dfrac{\partial \mathbf{B}}{\partial t} \\ \nabla \times \mathbf{H} = \mathbf{J} + \dfrac{\partial \mathbf{D}}{\partial t} \end{cases}$$

$$\begin{cases} \mathbf{D} = \epsilon_0 \mathbf{E} + \mathbf{P} \\ \mathbf{H} = \dfrac{1}{\mu_0}\mathbf{B} - \mathbf{M} \end{cases}$$

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$$\begin{cases} \mathbf{D} = \epsilon \mathbf{E} \\ \mathbf{H} = \dfrac{1}{\mu}\mathbf{B} \end{cases}$$

Don't Go Breaking My Heart - Backstreet Boys

$$
\begin{cases}
\nabla^2\mathbf{E} - \mu\epsilon\dfrac{\partial^2\mathbf{E}}{\partial t^2} = \dfrac{1}{\epsilon}\boldsymbol{\nabla}\rho + \rho\boldsymbol{\nabla}\dfrac{1}{\epsilon} - \boldsymbol{\nabla}\left(\dfrac{\mathbf{E}\cdot\boldsymbol{\nabla}\epsilon}{\epsilon}\right) \\
\qquad\qquad\qquad\qquad + \mu\dfrac{\partial\mathbf{J}}{\partial t} + \mu\boldsymbol{\nabla}\left(\dfrac{1}{\mu}\right)\times(\boldsymbol{\nabla}\times\mathbf{E}) \\
\nabla^2\mathbf{B} - \mu\epsilon\dfrac{\partial^2\mathbf{B}}{\partial t^2} = \mathbf{J}\times\boldsymbol{\nabla}\mu - \mu\boldsymbol{\nabla}\times\mathbf{J} - \boldsymbol{\nabla}\times\left[\mu\mathbf{B}\times\boldsymbol{\nabla}\left(\dfrac{1}{\mu}\right)\right] \\
\qquad\qquad\qquad\qquad + \left[\dfrac{\boldsymbol{\nabla}\times\mathbf{B}}{\mu\epsilon} - \dfrac{\mathbf{J}}{\epsilon} - \dfrac{\mathbf{B}\times\boldsymbol{\nabla}\left(\frac{1}{\mu}\right)}{\epsilon}\right]\times[\mu\boldsymbol{\nabla}\epsilon + \epsilon\boldsymbol{\nabla}\mu]
\end{cases}
$$

I Want It That Way - Backstreet Boys

Hipóteses sobre o meio:

1. linear;
2. dielétrico ($\mu = \mu_0$);
3. homogêneo ($\nabla \epsilon = \mathbf{0}$).

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Happier - Marshmello, Bastille

$$
\begin{cases}
\nabla^2\mathbf{E} - \mu_0\epsilon\dfrac{\partial^2\mathbf{E}}{\partial t^2} = \dfrac{1}{\epsilon}\boldsymbol{\nabla}\rho + \cancelto{0}{\rho\boldsymbol{\nabla}\dfrac{1}{\epsilon}} - \boldsymbol{\nabla}\left(\dfrac{\cancelto{0}{\mathbf{E}\cdot\boldsymbol{\nabla}\epsilon}}{\epsilon}\right) \\
\qquad + \mu_0\dfrac{\partial\mathbf{J}}{\partial t} + \mu_0\cancelto{0}{\boldsymbol{\nabla}\left(\dfrac{1}{\mu_0}\right)} \times (\boldsymbol{\nabla}\times\mathbf{E}) \\
\nabla^2\mathbf{B} - \mu_0\epsilon\dfrac{\partial^2\mathbf{B}}{\partial t^2} = \mathbf{J}\times\cancelto{0}{\boldsymbol{\nabla}\mu_0} - \mu_0\boldsymbol{\nabla}\times\mathbf{J} - \boldsymbol{\nabla}\times\left[\mu_0\mathbf{B}\times\cancelto{0}{\boldsymbol{\nabla}\left(\dfrac{1}{\mu_0}\right)}\right] \\
\qquad + \left[\dfrac{\boldsymbol{\nabla}\times\mathbf{B}}{\mu_0\epsilon} - \dfrac{\mathbf{J}}{\epsilon} - \dfrac{\mathbf{B}\times\cancelto{0}{\boldsymbol{\nabla}\left(\frac{1}{\mu_0}\right)}}{\epsilon}\right] \times \left[\mu_0\cancelto{0}{\boldsymbol{\nabla}\epsilon} + \epsilon\cancelto{0}{\boldsymbol{\nabla}\mu_0}\right]
\end{cases}
$$

Happier - Marshmello, Bastille

$$\begin{cases} \nabla^2 \mathbf{E} - \mu_0 \epsilon \dfrac{\partial^2 \mathbf{E}}{\partial t^2} = \dfrac{1}{\epsilon} \boldsymbol{\nabla} \rho + \mu_0 \dfrac{\partial \mathbf{J}}{\partial t} \\ \nabla^2 \mathbf{B} - \mu_0 \epsilon \dfrac{\partial^2 \mathbf{B}}{\partial t^2} = -\mu_0 \boldsymbol{\nabla} \times \mathbf{J} \end{cases}$$

Wouldn't It Be Nice - The Beach Boys

$$\mathbf{E}(\mathbf{r}, t) = \frac{1}{4\pi\epsilon_0}\int_{\mathcal{V}_0} \text{solução no vácuo}\, \mathrm{d}\tau' + \frac{1}{4\pi\epsilon_1}\int_{\mathcal{V}_1} \text{solução no meio}\, \mathrm{d}\tau'$$

God Only Knows - The Beach Boys

Propriedades esperadas de uma solução:

1. reflexão e refração;
2. mudanças de velocidade;
3. presença de um dielétrico afeta a solução;
4. et cetera.

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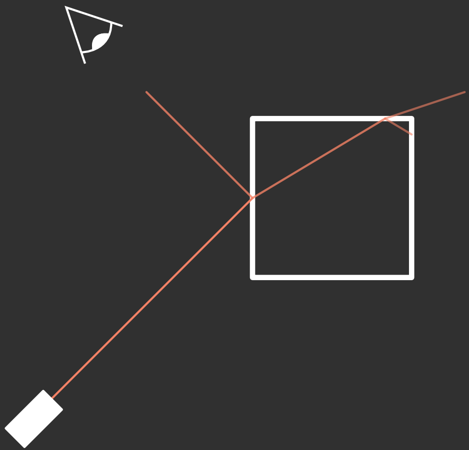
In The End
Linkin Park

Everybody (Backstreet's Back)

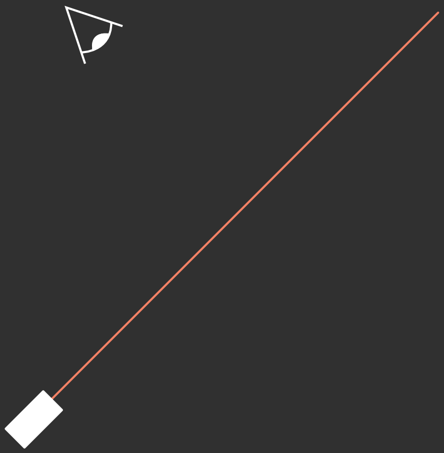
Backstreet Boys

You Found Me - The Fray



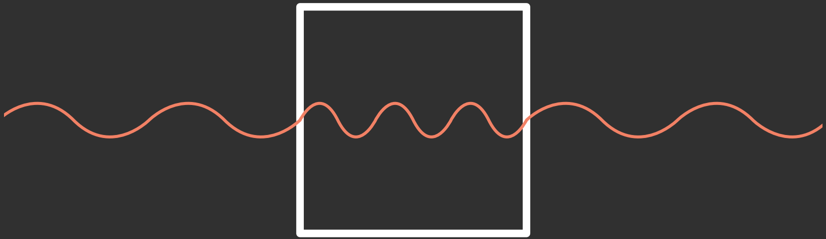
Voltar

Don't Matter - Akon



Voltar

Stop - Spice Girls



Voltar

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