APPENDIX 1: DERIVATION OF THE SPEED OF LIGHT FROM MAXWELL'S EQUATIONS

Given Maxwell's basic equation

$$\nabla \times E = \frac{\partial B}{\partial t} \quad \nabla \times B = \mu_0 \varepsilon_0 \frac{\partial E}{\partial t}$$

$$\nabla \cdot E = 0 \quad \nabla \cdot B = 0$$

We then compute

$$\nabla \times (\nabla \times E) = -\frac{\partial (\nabla \times B)}{\partial t} = -\mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$$

Therefore

$$\nabla^2 E = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$$

Using the basic definition for the energy of a wave

$$E = E_0 \sin \left(2\pi \frac{x-\nu t}{\lambda}\right)$$

After differentiating the above equation we get

$$\frac{\partial^2 E}{\partial x^2} = -E_0 \left(\frac{2\pi}{\lambda}\right)^2 \sin \left(2\pi \frac{x-\nu t}{\lambda}\right) \text{ and } \frac{\partial^2 E}{\partial t^2} = -E_0 \left(\frac{2\pi\nu}{\lambda}\right)^2 \sin \left(2\pi \frac{x-\nu t}{\lambda}\right)$$

Then after substituting back into our wave equation

$$\nu^2 = \frac{1}{\mu_0 \varepsilon_0}$$

Therefore

$$\nu = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = \sqrt{\frac{1}{(8.85418782 \times 10^{-12} \text{ m}^{-3} \text{ kg}^{-1} \text{ s}^4 \text{ A}^{-2}) \times (1.25663706 \times 10^{-6} \text{ m kg} \text{ s}^2 \text{ A}^{-2})}} = 2.99792458 \times 10^8 \text{ m/s}$$

This is the exact value for the speed of light as it is known today.