# pyrmittivity Documentation

***Release 0.1.0***

**Ian Nesbitt**

**Nov 11, 2021**

# MODULES

pyrmittivity is a simple module designed to calculate Maxwell's Equations describing Permittivity.

See an explanation of Permittivity at a site dedicated to Maxwell's Equations here.

CHAPTER

# ONE

# CORE FUNCTIONS

The constants used in these functions are defined in *Constant definitions*.

## 1.1 Wave velocity

pyrmittivity.core.**celerity**(*E_r*)

Calculate the wave velocity ($C_r$) given the permittivity ($\varepsilon_r$) of the dielectric.

$$C_r = \frac{1}{\sqrt{\mu_0 \varepsilon_r \varepsilon_0}} \tag{1.1}$$

**Parameters** **E_r** (*float*) – Permittivity of the dielectric ($\varepsilon_r$)

**Return type** float

See Equation [6] of Maxwell's Equations.

## 1.2 Permittivity

pyrmittivity.core.**epsilon_r**(*C_r*)

Calculate the permittivity ($\varepsilon_r$) given the wave velocity through the dielectric ($C_r$).

$$\varepsilon_r = \frac{\frac{1}{C_r}^2}{\mu_0 \varepsilon_0} \tag{1.2}$$

**Parameters** **C_r** (*float*) – Wave velocity through the dielectric ($\varepsilon_r$)

**Return type** float

See Equation [6] of Maxwell's Equations.

## 1.3 Wavelength

pyrmittivity.core.**wavelength**(*f*, *E_r*)

Calculate the wavelength ($\lambda$) given the permittivity and frequency ($\varepsilon_r$ and $f$).

$$\lambda = \frac{C_0}{f\sqrt{\varepsilon_r}} \tag{1.3}$$

**Parameters**

- **f** (*float*) – Frequency of the wave ($f$)
- **E_r** (*float*) – Permittivity of the dielectric ($\varepsilon_r$)

**Return type** float

See Equation [7] of Maxwell's Equations.

## 1.4 Velocity conversions

### 1.4.1 m/s to m/ns

pyrmittivity.core.**m_per_ns**($v$)

Calculate meters per nanosecond from meters per second. Can be useful for software that uses m/ns velocity definitions.

$$C_{m*ns^{-1}} = {C_r}^{-9} \tag{1.4}$$

**Parameters** **v** (*float*) – Velocity of the wave ($C_r$)

**Return type** float

### 1.4.2 m/ns to m/s

pyrmittivity.core.**m_per_sec**($v$)

Calculate meters per second from meters per nanosecond. Can be useful for software that uses m/ns velocity definitions.

$$C_r = {C_{m*ns^{-1}}}^{9} \tag{1.5}$$

**Parameters** **v** (*float*) – Velocity of the wave ($C_r$)

**Return type** float

CHAPTER

TWO

# CONSTANT DEFINITIONS

These are physical constants that are used in the core functions.

| Variable | Symbol | Value |
|---|---|---|
| Speed of light | $C_0$ | 299792458 |
| Vacuum permittivity | $\varepsilon_0$ | $8.8541878 * 10^{-12}$ |
| Vacuum permeability | $\mu_0$ | $1.257 * 10^{-6}$ |

# INDEX