0.1 Solving $Ax = b$ using MaxwellFDS

0.1.1 Theory

We need to solve Maxwell's equations, that is,

$$\nabla \times E = -\mu \frac{\partial H}{\partial t} \tag{1a}$$

$$\nabla \times H = J + \epsilon \frac{\partial E}{\partial t}, \tag{1b}$$

where E, H, and J are the electric, magnetic and electric current vector fields, respectively, ϵ is the permittivity and μ is the permeability.

Assuming the time dependence $\exp(-i\omega t)$, where ω is the angular frequency, these become

$$\nabla \times E = -i\mu\omega H \tag{2a}$$

$$\nabla \times H = J + i\epsilon\omega E, \tag{2b}$$

which we can combine to form the time-harmonic wave equation for E,

$$\nabla \times \mu^{-1} \nabla \times E - \epsilon\omega^2 E = -i\omega J, \tag{3}$$

which we will solve using MaxwellFDS.

Note that the alternative wave equation for H, where we consider the magnetic current source M instead of J,

$$\nabla \times \epsilon^{-1} \nabla \times H - \mu\omega^2 H = -i\omega M, \tag{4}$$

can also be solved using MaxwellFDS.

0.1.2 Numerical

To solve (0.1.1) we discretize our vector fields on the Yee grid as shown in **??**.

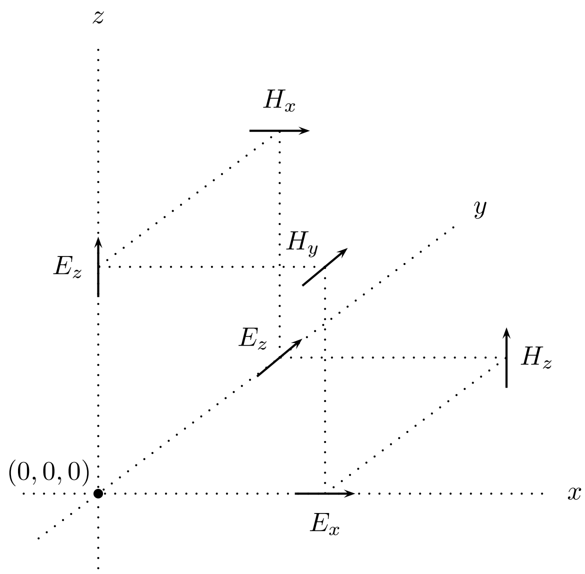

Figure 1: Primitive Yee cell