356(3): Solution for Electric Component of Plane Waves.

In general:

$$\underline{E} = x(\underline{v} \cdot \underline{\nabla})\underline{v} \quad -(1)$$

where

$$x = \left(\frac{\rho_m}{\rho}\right)(\text{material}) \quad -(2)$$

Here $\underline{E}$ refers to the material and $\underline{v}$ refers to the vacuum, i.e. spacetime or aether. In general, the velocity field of spacetime is:

$$\underline{v} = \underline{v}(X(t), Y(t), Z(t), t) \quad -(3)$$

and the spacetime is considered to be a fluid.

In Cartesian coordinates:

$$\underline{E} = E_X \underline{i} + E_Y \underline{j} + E_Z \underline{k} \quad -(4)$$

and:

$$(\underline{v} \cdot \underline{\nabla})\underline{v} = \left(v_X \frac{\partial}{\partial X} + v_Y \frac{\partial}{\partial Y} + v_Z \frac{\partial}{\partial Z}\right)\left(v_X \underline{i} + v_Y \underline{j} + v_Z \underline{k}\right) \quad -(5)$$

Therefore:

$$E_X = \left(v_X \frac{\partial}{\partial X} + v_Y \frac{\partial}{\partial Y} + v_Z \frac{\partial}{\partial Z}\right) v_X \quad -(6)$$

$$E_Y = \left(v_X \frac{\partial}{\partial X} + v_Y \frac{\partial}{\partial Y} + v_Z \frac{\partial}{\partial Z}\right) v_Y \quad -(7)$$

2) and

$$E_Z = \left(V_X \frac{\partial}{\partial X} + V_Y \frac{\partial}{\partial Y} + V_Z \frac{\partial}{\partial Z} \right) V_Z \quad -(8)$$

Given the three components E_X, E_Y, E_Z for any electric field strength $\underline{E}$ in volts per metre, there are three non-linear differential equations in three unknowns, V_X, V_Y and V_Z.

For a plane wave:

$$E_X = \frac{E^{(0)}}{\sqrt{2}} \exp\left(i \left(\omega t - \kappa Z \right) \right) \quad -(9)$$

$$E_Y = -\frac{iE^{(0)}}{\sqrt{2}} \exp\left(i \left(\omega t - \kappa Z \right) \right) \quad -(10)$$

$$E_Z = 0 \quad -(11)$$

Computer algebra can be used to solve eqns. (6) to (8) simultaneously for any boundary conditions.