EM WAVE GENERATION

Introduction to Electromagnetic waves

. The light that comes from the sun or the light from a light bulb that allows us to read in an otherwise dark room is electromagnetic radiation. However, the electromagnetic vibrations that is possible extend well beyond what our eyes can perceive. Similarly, radio waves that we pick up on a radio

as are the TV signals that are transmitted by our television station are also a form of thiselectromagnetic radiation.

Electromagnetic wave generation and equations

The Helmhotz Equation:

In source free linear isotropic medium, Maxwell equations in phasor form are,

$$\nabla\times\vec{E} = -j\omega\mu\vec{H} \qquad \nabla\times\vec{E} = 0$$

$$\nabla\times\vec{H} = j\omega\varepsilon\vec{E} \qquad \nabla\times\vec{H} = 0$$

$$\therefore \nabla\times\nabla\times\vec{E} = \nabla\left(\nabla\times\vec{E}\right) - \nabla^2\vec{E} = -j\omega\mu\nabla\times\vec{H}$$

or, $-\nabla^2\vec{E} = -j\omega\mu(j\omega\varepsilon\vec{E})$

or, $\nabla^2\vec{E} + \omega^2\mu\varepsilon\vec{E} = 0$

or, $\nabla^2\vec{E} + k^2\vec{E} = 0$ where $k = \omega\sqrt{k\varepsilon}$

An identical equation can be derived for $\vec{H}$.

i.e., $\nabla^2\vec{H} + k^2\vec{H} = 0$

These equations

$$\left.\begin{aligned} &\nabla^2\vec{E} + k^2\vec{E} = 0 \quad \ldots\ldots(a) \\ \&\quad &\nabla^2\vec{H} + k^2\vec{H} = 0 \quad \ldots\ldots(b) \end{aligned}\right\} \ldots\ldots(6.1)$$

are called homogeneous vector Helmholtz's equation.