EE-305
ELECTROMAGNETIC WAVES
Group Project-4
Plotting Electric and Magnetic fields in a lossy medium

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Project description:

In this project, we plot the electric and magnetic field vectors of a uniform plane wave propagating in the +z direction, whose electric field expression is given by:

$$E(z,t) = E_o e^{-\alpha z} \cos(\omega t - \beta z + \phi) \, \hat{a}_x$$

And magnetic field intensity is given by:

$$H(z,t) = (E_o / |\eta|) e^{-\alpha z} \cos(\omega t - \beta z + \phi - \theta) \, \hat{a}_y$$

- We have used MATLAB app designer to generate the 3D plots of transverse electromagnetic wave.
- By using this app we can plot the EM waves with different values of the parameters written below.

The following parameters are used while plotting the wave:

Intrinsic Impedance (η): Intrinsic Impedance of a medium can be defined as the impedance or obstruction that an electromagnetic wave faces while traveling in a medium. Its magnitude is given by the ratio of the magnitude of the electric and magnetic fields.

Attenuation Constant (α): The attenuation constant is the measure of the spatial rate of decay of the electromagnetic wave in the medium.

Angular Frequency (ω): The angular frequency refers to the angular displacement of any wave element per unit of time.

Phase Constant (β): It represents the change in phase per unit length along the path travelled by the wave at any instant. Its magnitude is given by a ratio of 2π and wavelength of the wave (λ).

Phase delay (ϕ): The phase delay gives the time delay in seconds experienced by each sinusoidal component of the input signal.

Phase difference (θ): It is the phase difference between the electric and magnetic field.