EE-305 PROJECT REPORT

GROUP-09

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PROJECT DESCRIPTION: Determine the polarisation (linear/circular/elliptical, and right-/left-handed) of a uniform plane wave, whose electric field is expressed in phasor notation as $\vec{E}(z,t) = \widehat{a_x} E_{10} e^{-j\beta z} + \widehat{a_y} E_{20} e^{-j\beta z} e^{j\phi}$. Plot the instantaneous electric field intensity E(z,t). Assume a lossless medium (α = 0). The parameter values E_{10}, E_{20}, β, ϕ will be provided from the user-end.

POLARISATION:

Polarisation applies to sinusoidal waves. The general expression for a sinusoidal plane wave is:

E=$E_{x0} cos(wt - k * z + \phi_x) \widehat{e_x} + E_{y0} cos(wt - k * z + \phi_y) \widehat{e_y}$

We can usually suppress the spatial dependence of the field and write the electric field vector as

E=$E_{x0} cos(wt + \phi_x) \widehat{e_x} + E_{y0} cos(wt + \phi_y) \widehat{e_y}$

CLASSIFICATION OF POLARISATION: Polarisation is classified into three types:

1. **Linear polarisation:** It is a confinement of the electric field vector or magnetic field vector to a given plane along the direction of propagation.

When Phase difference is ϕ = 0 or nπ or $\phi_x = \phi_y$, the field is linearly polarised.

2. **Circular polarisation**: the electric field of light of two linear components that are perpendicular to each other.

   When the amplitudes are the same, *Ex* = *Ey*, but the phases differ by ±*π/2.*

   The resulting electric field rotates in a circle around the direction of propagation and, depending on the rotation direction, is called left-or right-hand circularly polarised.

3. **Elliptical polarisation**: This results from combining two linear components with different amplitudes and a phase difference that is not π/2.

In the code, polellip(FV) returns the tilt angle (in degrees) of the polarisation ellipse of the field specified in FV. FV can be either a row vector or a 2-row matrix containing the linear polarisation representation of the field. If FV is a matrix, each column in FV represents the field in the form of [Eh; Ev], where Eh is the horizontal component of the field and Ev is the vertical component of the field. If FV is a vector, each entry in FV represents the polarisation ratio, Ev/Eh, of a unit-power field.

TAU is a row vector whose number of columns matches the number of columns in FV. Each entry in TAU represents the tilt angle of the polarisation ellipse associated with the corresponding field specified in FV. TAU is defined as the angle between the horizontal axis and the major axis of the polarisation ellipse and is within the range of [-90,90].