

POLARIZATION SINGULARITIES  
IN THREE-DIMENSIONAL OPTICAL  
FIELDS: THE NEXT FRONTIER

*I. Freund*

Physics Department, Bar-Ilan University  
(Ramat-Gan 52900, Israel)

S u m m a r y

Polarization singularities are studied in simulated elliptically polarized, three dimensional random wave fields. The coherency matrix is shown to provide a highly useful tool for the study of singular points of circular polarization,  $C$  points, and singular points of linear polarization,  $L$  points. Both types of points are organized into continuous lines,  $C$  lines and  $L$  lines, respectively, that meander throughout the field. These lines were traced out by tracking zeros of appropriate discriminants of the characteristic equation of the coherency matrix. The ellipse winding number of a singularity ( $C$  or  $L$  point) was defined in terms of the rotation of the polarization figures surrounding the singularity. Using the eigenvalues and eigenvectors of this matrix, together with a complex Stokes field representation of the singularities, sign inversions of the ellipse winding number of  $C$  points were found on  $C$  lines, and switches in ellipse winding number of  $L$  points were found on  $L$  lines. The former finding is in accord with the current theory, the latter is not encompassed by any current theory. A qualitative explanation of these findings is presented.