# Generalized telegraphists' equations for electromagnetic wave scattering from a rough interface above chiral medium

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In order to derive full wave solutions for electromagnetic wave scattering from rough interfaces between an achiral medium (free space for instance) and chiral medium that satisfies generalized constitutive relations, it is necessary to employ complete modal expansions for the electromagnetic fields above and below the interface. The modal expansions are derived from the Fourier, harmonic expansions through contour deformations around branch cuts and poles in the complex wave number plane. Maxwell's equations are converted into generalized telegraphists' equations upon the imposition of exact boundary conditions at the rough interface. These telegraphist's equations are coupled first order differential equations for the forward and backward traveling wave amplitudes associated with all the different species of waves (radiation, lateral, and surface plasmons for right and left circularly polarized waves) excited at the rough interface between the achiral medium and the chiral medium.

The novelty in this problem is that depolarization occurs due to surface roughness as well as the chiral property of the medium below the interface. The two contributions to depolarization can be distinguished by considering scattering in the neighborhood of specular and non-specular points on the surface. In the neighborhood of the specular points, the contribution to depolarization due to surface roughness is negligible and the contribution to depolarization due to the chiral property of the medium below the interface is pronounced. Moreover unlike depolarization due to surface roughness, the depolarized component due to the chiral property of the medium below the interface peaks at near grazing incidence. A physical interpretation of depolarization due to the chiral properties of the medium below the interface (which need not be rough) is presented.