URSI AP-RASC, Sydney, Australia, 17-22 August 2025

Radiation of a Dipole on the Axis of an Oblate Spheroid with Application to the Veselago Lens

Danilo Erricolo and Piergiorgio L. E. Uslenghi (*)
Department of Electrical and Computer Engineering, University of Illinois Chicago, USA
Emails: derric1@uic.edu, uslenghi@uic.edu

An oblate spheroidal penetrable object immersed in a linear, uniform, lossless and isotropic medium characterized by a real positive wavenumber k and a real positive intrinsic impedance Z_1 is considered in the phasor domain, with a time-dependence factor $\exp(+j\omega t)$ omitted throughout. The medium inside the spheroid is a linear, uniform, lossless and isotropic metamaterial that is anti-isorefractive to the surrounding medium and characterized by a real negative wavenumber $-k$ and a real positive intrinsic impedance Z_2. The primary source is an electric or magnetic dipole located outside the spheroid on the symmetry axis of the structure, and parallel to the axis.

The exact solution to the scattering boundary-value problem is obtained by expanding the field components as infinite series of oblate spheroidal wave functions and imposing the boundary conditions on the surface of the spheroid, utilizing previous results [1-4], leading to explicit analytical expressions for the modal expansion coefficients. An interesting practical application of this novel solution is the validation of previously obtained numerical results for the Veselago lens for the case of dipole sources, thus extending the two-dimensional results given in [5] to a three-dimensional case.

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