Abstract: We describe a semi-analytical formulation to solve for the fields of arbitrarily-oriented dipole current sources embedded in planar-stratified environments where each layer has arbitrary (diagonalizable) anisotropy, i.e. fully populated permittivity and permeability tensors that may include material loss. The canonical solution for the fields in planar-stratified environments is traditionally carried out using Sommerfeld integrals for cases exhibiting azimuthal (transverse) symmetry in the material properties. However, for the more general case treated here where one or more planar layers may lack azimuthal symmetry, one must resort to a more general Fourier-like double-integral. The numerical evaluation of the Green’s dyad in general planar-stratified environments presents various challenges, such as the presence of branch points, branch cuts, guided-wave/leaky-wave poles, an oscillatory integrand, and a numerical integration that is often plagued by convergence issues. Herein the formulation behind a robust numerical code designed to compute the fields radiated by dipole sources in general planar-stratified environments, emphasizing techniques used to overcome difficulties commonly present in the numerical evaluation of such Fourier synthesis integrals, is presented along with validation results in problems related to resistivity logging in anisotropic, planar-stratified subterranean environments.

*Full-text with restricted distribution.

Derivative bibliography: