Hamiltonian Treatment of Time Dispersive and Dissipative Media Within Linear Response Theory

Alex Figotin

`afigotin@uci.edu`

Department of Mathematics
University of California at Irvine
Irvine, CA 92697-3875
USA

Abstract

We develop a Hamiltonian theory for a time dispersive and dissipative (TDD) inhomogeneous medium, as described by a linear response equation respecting causality and power dissipation. The canonical Hamiltonian constructed here exactly reproduces the original dissipative evolution after integrating out auxiliary fields. In particular, for a dielectric medium we obtain a simple formula for the Hamiltonian and closed form expressions for the energy density and energy flux involving the auxiliary fields. The developed approach also allows to treat a long standing problem of scattering from a lossy non-spherical obstacle and, more generally, wave propagation in TDD media.