An Efficient ADE-WLP-FDTD Method with new WLPs and Factorized Splitting scheme for Dispersive Media Simulation

Gui-Ying Liu[1], Wei-Jun Chen[1], and Min Zhao[1]

[1]Lingnan Normal University

September 23, 2022

Abstract

Based on an auxiliary differential equation (ADE) and new weighted Laguerre polynomials (WLPs), an efficient 3-D finite-difference time-domain method (FDTD) with factorized-splitting (FS) scheme is proposed to calculate wave propagation in general dispersive materials. In order to model general dispersive materials, the ADE technique is introduced because it can establish the relationship between the electric displacement vector and the electric field intensity. Using a new temporal basis, the new WLPs can improve computational efficiency and save computing resources. The FS scheme is used to efficiently solve the huge sparse matrix equation of WLP-FDTD method into a sub-steps procedure. A numerical example is given to verify the accuracy and the efficiency of the proposed method. Compared with existing methods, the results from the proposed method show its superiority for dispersive media simulation.

Hosted file

`Manuscript_EL.docx` available at https://authorea.com/users/510135/articles/587311-an-efficient-ade-wlp-fdtd-method-with-new-wlps-and-factorized-splitting-scheme-for-dispersive-media-simulation