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Energy-Conserved S-FDTD Schemes in Computational Electromagnetics

Computational electromagnetics has been playing a more and more important role in the electromagnetic industry. Numerical modeling has emerged recently as a crucial enabling technology for many areas of application in the modern society, such as radio-frequency, microwave, integrated optical circuits, antennas, and wireless engineering. It is of special importance to develop efficient numerical methods for effective and accurately simulating propagation of electric and magnetic waves in large scale field and long time duration. On the other aspect, in lossless medium, it is well known that the density of the electromagnetic energy of the wave is constant at different times. Thus, keeping physically this invariance in time is a greatly important issue in constructing efficient numerical schemes for computing propagation of electromagnetic waves. However, most previous ADI or splitting schemes break this property of energy conservation. In this study, we develop energy-conserved splitting finite-difference time-domain schemes for electromagnetic computation. Both theoretical analysis and numerical experiment are taken to show the efficiency of the new schemes.

This is joint work with W. Chen and X. Li.