Optimized exponential operator coefficients for symplectic FDTD method

Authors: M. Kusaf ; A.Y. Oztoprak ; D.S. Daoud

Abstract:
A new symplectic finite difference time domain scheme is introduced. The scheme uses fourth-order finite differencing for space and a symplectic scheme with a propagator of exponential differential operators for time. The coefficients of the exponential operators are obtained by optimizing the higher order terms of the growth factor for high Courant stability limit as well as by using the Taylor's series expansion of the exponential operator for up to the second-order term. When the Taylor's series expansion of the exponential operator is considered the new scheme is second-order in time, but the dispersion performance of the scheme is similar to the performance of the fourth-order symplectic schemes previously reported. The stability performance is shown to be better, and as the new scheme uses smaller number of exponential operators it also reduces the computational time. One other advantage of this scheme is that it is flexible in the choice of the coefficients, which allows the coefficients to be chosen according to performance requirements.

Available at: https://ieeexplore.ieee.org/document/1390973