Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Implicit time-domain simulation of metamaterials on GPUs[1] SIMON COOKE, BARUCH LEVUSH, Naval Research Laboratory — Metamaterials present a challenge to 3D electromagnetic simulation due to their sub-wavelength structural features, demanding spatial grid cell sizes typically $\approx \lambda/50$. This is similar to the situation found modeling conventional slow-wave structures, such as TWTs. For explicit, finite-difference time-domain (FDTD) techniques, numerical stability further dictates the use of very small time steps, leading to long simulation times for wave propagation in metamaterials. We present simulations using a new alternating direction implicit (ADI) FDTD algorithm [1,2] implemented efficiently for high performance graphics processing units (GPUs). Our method uses a complex-envelope representation for the field amplitudes to factor out the rf timescale, and is absolutely stable. Consequently, we are able to use time steps comparable to the rf period for narrow-bandwidth simulations, and reduce simulation times by orders of magnitude compared to conventional FDTD on CPUs. Simulation results will be presented for a number of metamaterial structures.
[1] S. J. Cooke *et al.*, Int. J. Numer. Model., 22, 187 (2009)
[2] M. Botton *et al.*, IEEE Trans. Plasma Sci., 38 (6), 1439 (2010)

[1]Supported by ONR

Simon Cooke
Naval Research Laboratory

Date submitted: 29 Jul 2010 Electronic form version 1.4