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Modeling Wave Propagation in Cells and Tissues at the Microscopic Level TIMOTHY DOYLE, Dept. of Physics, Utah State University, Logan, UT 84322-4415, KEITH WARNICK, Dept. of Physics, Utah State University, Logan, UT 84322-4415 — Several proposed medical therapies and diagnostic methods are based on the interaction of ultrasonic or electromagnetic waves with cells and tissues at the microscopic level. To better understand these interactions, models are being developed to simulate wave propagation in tissues at the cellular level by incorporating a first-order approximation for the cell structure and multiple scattering between cells. The cells are modeled with a concentric spherical shell-core structure embedded in a medium, with the core, shell, and medium representing the nucleus, cytoplasm, and extracellular matrix respectively. Using vector multipole expansions and boundary conditions, scattering solutions are derived for a single cell with varying properties for each of the cell components. Multiple scattering between cells is simulated using addition theorems to translate the multipole fields from cell to cell and an iterative process to refine the scattering solutions. Results from ultrasonic scattering simulations are presented, including single-cell spectra and wave field images for up to several hundred cells.

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