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Simulating Electromagnetic Propagation through Nanowire Arrays of Varying Geometric Arrangements[1] NATHANIEL HAWK, JUTTA LUETTMER-STRATHMANN, RYAN TOONEN, University of Akron — Nonreciprocal devices restrict the propagation direction of electromagnetic (EM) waves and are commonly used to isolate signals in millimeter-wave (mmW) communication and remote sensing systems. Nonreciprocity in mmW components is often realized by Faraday rotation, a time reversal symmetry breaking process that rotates linear polarization direction about the axis of propagation. Faraday rotation results from the interaction of an EM wave with an anisotropic medium–commonly realized by immersing a ferrite in a static magnetic field. Artificial ferrites composed of irregularly spaced ferromagnetic nanowires embedded in dielectric membranes have been experimentally explored. We employ the finite difference time domain method to understand whether or not models that include regularly spaced nanowires will yield the same propagation results as those that include irregular spacing. In our simulations, we vary lattice geometries while keeping nanowire density constant. We model the interaction of dielectric nanowire arrays with short-wavelength EM waves (having wavelengths comparable to the nanowire spacing). Our long-term goal is to model Faraday rotation resulting from the interaction of artificial ferrites with mmWs (having relatively long wavelengths).

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