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Nonlocal Response of Plasmonic Nanowire Metamaterials in the ENZ Regime BRIAN WELLS, University of Massachusetts Lowell, ANATOLY ZAYATS, Kings College London, VIKTOR PODOLSKIY, University of Massachusetts Lowell — Nanowire metamaterials are a class of materials formed by an array of aligned plasmonic nanowires embedded in a dielectric host which exhibit strongly anisotropic behavior. For a wide range of excitation frequencies, the optical properties of these systems are dominated by two waves with different polarizations. In contrast to this behavior, in the epsilon-near-zero (ENZ) frequency range, excitation of additional wave mode has been observed. In this frequency range the contribution of spatial dispersion becomes increasingly important and a modified dispersion relationship for the anisotropic metamaterials must be used. The properties of the additional wave need to be taken into consideration during design and analysis of the properties of nanowire-based systems. Here we present analytical and computational studies of the nonlocal optical response of plasmonic nanowire metamaterials. Dispersion of photonic modes of plasmonic metamaterials have been studied as a function of wavelength, geometry, and material parameters. A new analytical description of the optical properties of nonlocal nanowire systems has been developed. It is shown that the optical response of the system results from the coupling of conventional effective-medium-dominated oscillations with plasmon-polariton-type oscillations. The presented model is in agreement with numerical solutions of Maxwell's equations.

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