Abstracts

Variational nonquasi-static formulations for the impedance of planar transmission lines

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This paper investigates the possible variational behavior of transmission-line parameters established for planar structures by using a nonquasi-transverse-electromagnetic full-wave formalism. A variational principle for the propagation constant is linked to the power flow and magnetic and electric densities of energy by means of a functional expressing the complex power balance for an infinitesimal line length. It is first shown that using this variational principle for the propagation constant renders the power balance functional stationary, but does not ensure a variational behavior for the power and energies. For this reason, the stationarity of the power flow is investigated by defining an equivalent reaction for the Poynting vector. By doing so, a full-wave variational expression for the characteristic impedance is derived, which is a main and new result. The theoretical observations are confirmed by simulations carried out on three different topologies of planar lossy guiding structures. It is observed that the new formulation for the characteristic impedance is extremum for the value of the trial field components, which renders the propagation constant stationary.

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