Abstracts

S-domain methods for simultaneous time and frequency characterization of electromagnetic devices

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An efficient procedure is developed for simultaneously characterizing the time-domain and frequency-domain behavior of electromagnetic devices. The procedure works in the complex-frequency plane called the s-domain-and provides an analytical expression for the behavior of the device at any frequency and for any transient excitation. This analytical expression is obtained by first evaluating a reduced-order model of the poles and zeros of the device. These poles and zeros are then used to characterize the device in terms of rational polynomials in the s-domain. Two different methods for evaluating reduced-order models are presented. One is called asymptotic waveform evaluation (AWE) and is combined with the finite-element method; the other is called adaptive Lanzcos-Pade sweep (ALPS) and is combined with the boundary-element method. The resulting reduced-order models provide the frequency-domain behavior of the device over a broad bandwidth. Using the Laplace transform, these reduced-order models also provide the time-domain behavior. Several numerical examples have been run using commercial electronic design automation (EDA) software to demonstrate that this solution procedure is a highly efficient and accurate way to characterize the electromagnetic performance of real-life devices.

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