Abstracts

On the generalized scattering matrix of a lossless multiport

In characterizing interacting discontinuities in a waveguide increasing use is made of the so called generalized scattering matrix (GSM) formalism in order to describe 'accessible modes' below cutoff. This is motivated by the intrinsic numerical stability of the scattering matrix with respect to the transmission matrix, for instance. Unfortunately, we found that in many recent works and textbooks the GSM of a length of waveguide involving a mode above cutoff and several ones below cutoff is defined so that unitarity of the matrix and hence power conservation is not preserved. Still, numerical values of the fundamental mode scattering parameters reported as examples by the same references appear to be correct. In solving this apparent paradox, we address the problem of correctly defining the GSM for lossless modes below cutoff and alert the reader to the drawbacks of using a definition that does not maintain unitarity.

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