Abstracts

Reconstruction of permittivity profiles in cylindrical objects illuminated by higher order TE/sub mn/ and TM/sub mn/ modes

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An improved and accurate technique for the reconstruction of radially dependent permittivity profiles in cylindrical objects illuminated by higher order TE/sub mn/ and TM/sub mn/ cylindrical modes is presented in this paper. The technique is based on a general kind of integral transform of the measured frequency-dependent reflection data and the recently suggested renormalization technique to obtain a unique solution of the corresponding inverse problem. Nonlinear Riccati-similar differential equations for a properly defined reflection coefficient for both TE/sub mn/ and TM/sub mn/ cylindrical modes have first been derived in a unified way for this purpose. These equations have then been inverted using our proposed renormalization technique to uniquely obtain the unknown permittivity profile in terms of a Hankel transform of measured reflection coefficient data. About 150-200 measurement data points over a wide frequency band (wavelength ranging from one-fifth of the inner diameter of the cylindrical object to infinity) have been used for the reconstruction. A dummy time variable has been introduced to improve the overall reconstruction process. This variable has then been transformed into the spatial one with the help of a proposed numerical algorithm. A number of reconstruction examples has been considered and a very good agreement has been found between the original and reconstructed profiles even for very high values of permittivity.

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