COMPUTATIONAL S-PARAMETER EXTRACTION OF AN INHOMOGENEOUS DIELECTRIC SLAB LOADED WAVEGUIDE

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The measurement of the transmission and reflection coefficents from a dielectric sample (inside a waveguide) is a crucial step in extracting its unknown constitutive parameters. The traditional method for measuring an unknown sample is to fill the cross-secion of the waveguide with a sample having parallel front and back faces. Unfortunately, during the material research phase of a development, an insufficient quantity of the sample may be available for such an experiment. Hence, it is advantegeous to develop a constitutive extraction method that does not requiere so much material. In previous work, the authors have developed a method that requires a small sample placed on the centerline of the waveguide. Increasingly, determining the sensitivity of an experimental technique is important to quantify the quality of the measurement. In the method mentioned above, there are a variety of potential error sources. Placing the dielectric sample inside the waveguide can result in a source of error by introducing unwanted shifting (right or left) relative to the cross-section centerline. by simulating the shifting of the slab and comparing these results with the experimental data, the impact of these errors can be better determined. To asses the error due to a leteral shift, a forward model is required that provides that S-parameters with the reference planes at the front and back surface of the sample. This can be acomplished using LSE- and LSM-modes. The formulation, however, is rather involved. In addition, more flexible computational electromagnetics models allow assessment of other types of sample shapes such as the case where the front and back faces are no longer parallel to each other. An example of such an analysis method is the finite element method (FEM). The authors have found that the finite element method, when used with the thru-reflect-line(TRL) calibration procedure, has proven to be an efficient and relable technique to simulate the electromagnetics of dielectric discontinuities withinn a rectangular waveguide. The formulation and examples of this techqnique will be presented at the meeting.

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