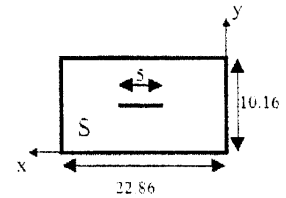
Efficient Full-Wave Modal Analysis of Waveguides with Arbitrary Geometry Defined by Straight, Circular and Elliptical Segments

S. Marini, P. Soto, S. Cogollos, and V. E. Boria
Dpto. de Comunicaciones, Universidad Politécnica de Valencia
Valencia, Spain

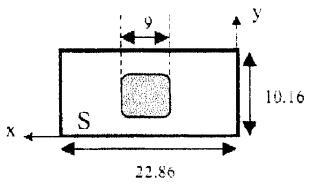
B. Gimeno
Dpto. de Física Aplica - I.C.M.U.V., Universidad de Valencia
Valencia, Spain

Many modern waveguide devices, such as dual-mode filters and diplexers, can be modelled considering the whole circuit as a cascade of waveguide step discontinuities. Most of such discontinuities usually involve waveguides with arbitrary cross-section defined by linear, circular and/or elliptical segments. A fast and accurate procedure for the full-wave modal characterization of such arbitrarily shaped waveguides is based on the Boundary Integral — Resonant Mode Expansion (BI-RME) technique well described in [1].

In this paper, we present a very efficient implementation of a full-wave modal analysis tool for arbitrarily shaped waveguides based on the BI-RME theory. Novel computational and geometry capabilities have been introduced with regard to the original implementation of BI-RME method [1]. For instance, our implementation can accurately consider waveguides whose cross section is composed of circular and elliptical segments, since they are not approached by straight segments. Furthermore, very strong efforts have been devoted to improve the CPU effort required by the BI-RME method, specially for complex waveguides. Results provided by our code are successfully compared in Figure 1 for the enclosed stripline and for a coaxial rectangular waveguide.



Fc (1) GHz	Fc (2) GHz	ERROR%
20.666955	20.641037	0.001
20.981585	20.961685	0.001
30.264167	30.226923	0.001
30.474869	30.429927	0.001
32.295360	32.290171	0.001
32.800748	32.760503	0.001



Fc (1) GHz	Fc (2) GHz	ERROR%
25.456151	25.456123	1E-04
25.458916	25.458881	1E-04
35.312001	35.311049	2E-03
35.317909	35.316954	2E-03
43.254162	43.252957	2E-03
43.262239	43.260953	2E-03

Figure 1: Cut-off frequencies of a closed stripline and of a coaxial rectangular waveguide obtained with a commercial code (1) and with our new efficient implementation (2).

REFERENCES

1. Conciauro, G., M. Bressan, and C. Zuffada, "Waveguide modes via an integral equation leading to a linear matrix eigenvalue problem," *IEEE Trans. Microwave Theory and Tech.,* Vol. 32, 1495–1504, November 1984.

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