Generation of Lumped Element Models of Distributed Microwave Circuits

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A method for generation of lumped element equivalent circuits and the corresponding systems of ordinary differential equations for distributed microwave circuits is presented. Starting with a TLM analysis of a distributed multiport circuit, the impulse response functions for reflection and transmission between the ports are computed. From these impulse responses the poles are extracted within a specified domain of the complex frequency plane. From these poles, canonical equivalent circuits are derived. In this way the topology as well as the parameters of the lumped element equivalent circuits are determined. The procedure has been applied to generate the equivalent circuits of one- and two-port waveguide components.

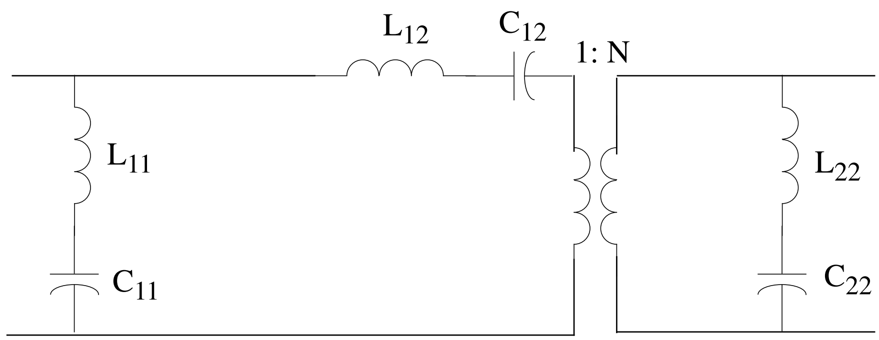

Fig. 1 Lumped element equivalent circuit of a general lossless two-port circuit. The element values are derived from the poles and their residues.

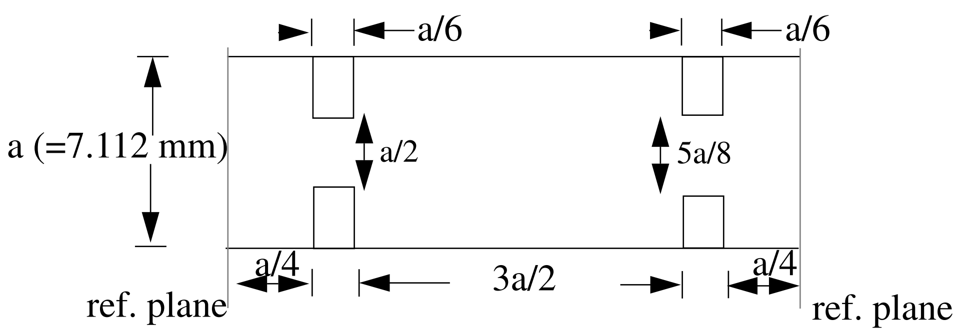

Fig. 2 Geometry of a non-symmetrical two-port iris-coupled resonator in a WR (28) waveguide

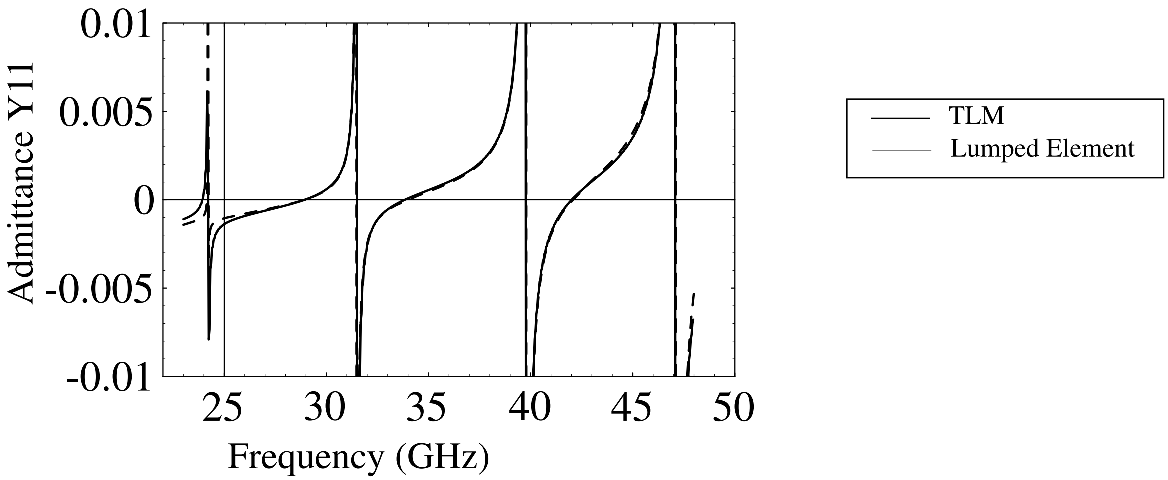

Fig. 3 The input admittance of the two-port iris coupled resonator shown in Fig. 2.

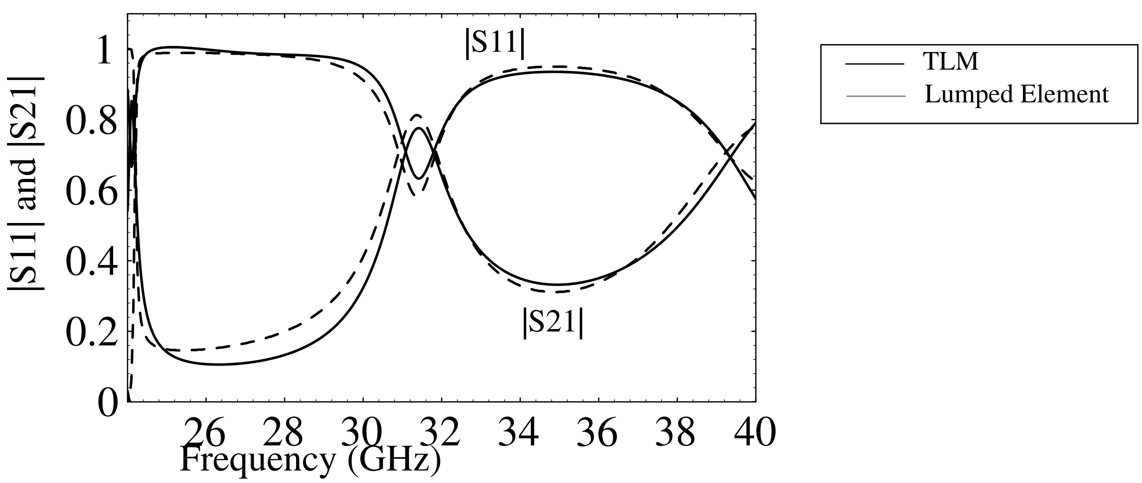

Fig. 4 Comparison of the S-parameters generated from lumped element model and direct TLM analysis

Details of this project can be found in the following papers:

- P.Russer, M.Righi, C.Eswarappa, W.J.R.Hoefer, "Generation of Lumped Element Models of Distributed Microwave Circuits" Proceedings of the 2nd International Workshop, Berlin 1993

- P.Russer, M.Righi, C.Eswarappa, W.J.R.Hoefer, "Lumped Element Equivalent Circuit Parameter Extraction of Distributed Microwave Circuits via TLM Simulation" To be presented at the 1994 International Microwave Symposium, San. Diego.