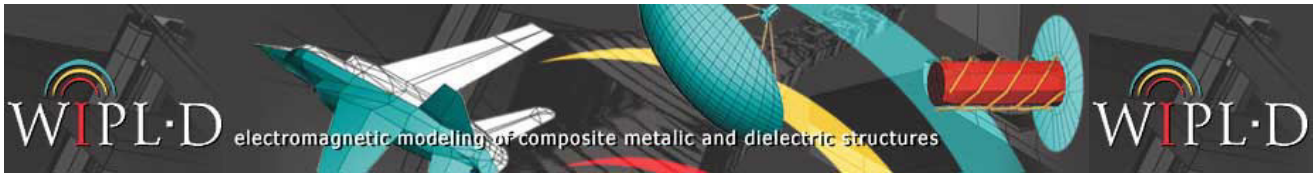

Design of Microwave Circuits Using WIPL-D Microwave

Introduction

Microwave circuit simulation is an integral part of design of microwave devices. Using full-wave EM simulation is not a good option for the starting calculations because it involves usage of great amount of memory and requires considerable simulation time. Thus, in circuit solvers, circuit elements are often modeled by predefined closed-form library components whose characterization is performed faster than the full-wave EM simulation. Although closed-form models have their drawbacks, in many cases using them is enough, or at least it gives a good estimate on the system performance early on in the design process.

WIPL-D Microwave

WIPL-D Microwave is a software package which serves as fast and accurate design and simulation tool for projects involving microwave circuits, components and antennas. It is integrated with WIPL-D EM solver, WIPL-D Optimizer and WIPL-D Time Domain Solver. Its user-friendly schematic capture allows easy circuit modeling, inclusion of user-defined EM component models, and import of data in Touchstone format. Component library includes closed-form and 3D EM models in four implementation technologies:

- Microstrip,
- Coplanar waveguide,
- Rectangular waveguide,
- Coaxial,

In addition, lumped elements and many idealized device models are available in the library.

WIPL-D Microwave can be used to develop complex structures such as:

- RF and microwave filters,
- Matching structures,
- Resonators,
- Directional couplers,
- Power dividers,
- Connectors.

Simulation Examples

Microwave circuits shown in Figs 1-3 are analyzed using WIPL-D Microwave.

The circuit shown in Fig. 1 is implemented in rectangular waveguide technology. It is a single-stub tuner which is used to match the circuit at 10 GHz. S_11 parameter of the circuit is shown in Fig. 2.

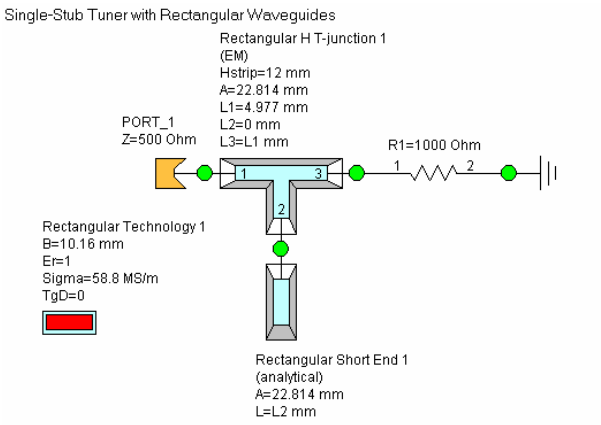

Figure 1. Single-stub tuner with rectangular waveguides

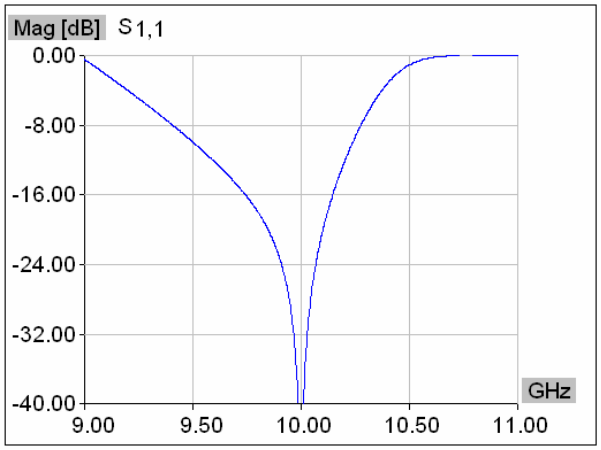

Figure 2. S_{11} parameter for the stub tuner

The circuit shown in Fig. 3 is a diplexer implemented in microstrip technology, intended to operate in 2 GHz and 2.2 GHz bands. Its S_{11} and S_{21} parameters are shown in Fig. 4.

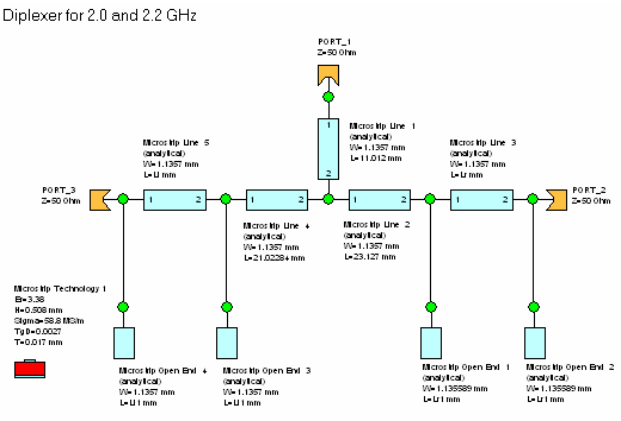

Figure 3. Diplexer

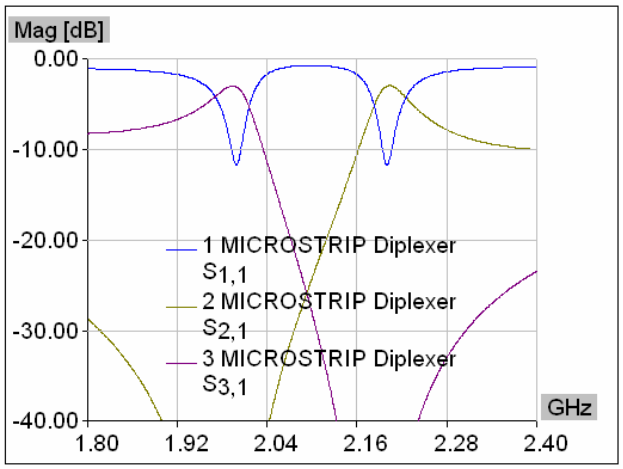

Figure 4. S parameters for the diplexer

The circuit shown in Fig. 5 is a Chebyshev impedance transformer implemented in coaxial technology designed to operate as a matching circuit in a wide band: from 2 GHz up to 8.5 GHz. Its S_{11} parameter is shown in Fig. 6.

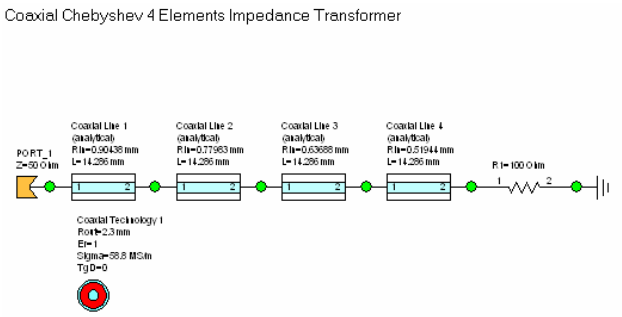

Figure 5. Coaxial Chebyshev impedance transformer

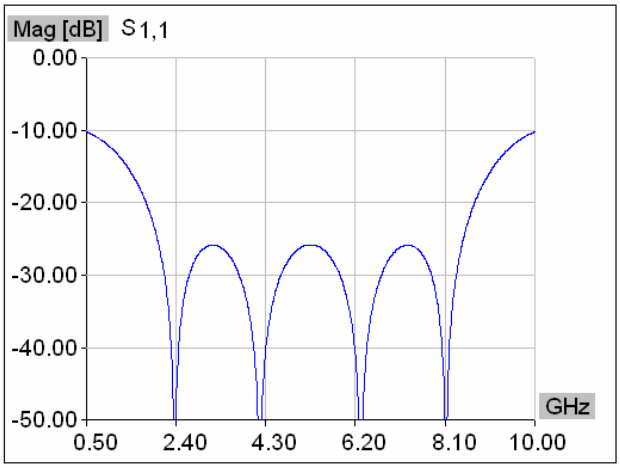

Figure 6. S_{11} parameter for Chebyshev impedance transformer

Conclusion

WIPL-D Microwave is a suitable tool for simulation of microwave circuits thanks to it user-friendly schematic capture, a library of components with several types of models (ideal, closed-form, EM) and a dynamic link with the 3D EM solver.

Three simple examples were presented here in order to show that WIPL-D Microwave can be a useful tool for circuit simulation even if no EM simulation is required.