WIPL-D Microwave Pro: What is New in v4.0?

Improvements/new features introduced in v4.0 are:

1. Improved analysis of frequency dependent materials
2. Enhanced functionality of tuner
3. One mouse click transformation from schematic to microstrip layout
4. Two ideal transformer elements enabling mixed-mode S parameter analysis of differential circuits
5. General ideal coupled line element
6. General power divider element
7. Four terminal transmission line elements (floating ground)
8. Updated controlled sources elements with delay included

1. Improved analysis of frequency dependent materials

In the new release of the program, an electromagnetic structure can include frequency dependent materials. This new feature has been introduced through a new function, *freq()*, available in the Symbol table. The function returns the current value of a project frequency, i.e. the operating frequency. Such a function can be very useful for various purposes e.g. to define a frequency-dependent quantity. An example of using project frequency to define frequency-dependent relative dielectric constant is shown in Fig. 1.

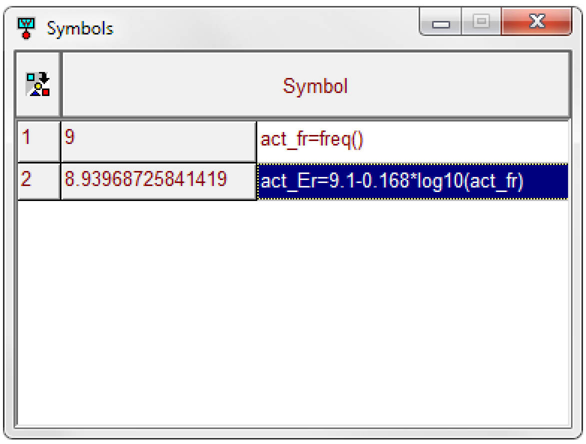

Figure 1. Frequency dependent relative dielectric constant.

2. Enhanced functionality of tuner

Tuner tool enables the user to tune their circuits in real time and simultaneously observe multiple output results. With enhanced functionality available in new version, several variables can be selected and tuned in parallel for efficient design of both, microwave circuits with schematic elements, and EM components.

3. One mouse click transformation from schematic to microstrip layout

When working with microstrip circuits, it is convenient to use analytical or EM models of circuit elements to obtain required specification for the circuit as the simulations are fast and the accuracy is acceptable.

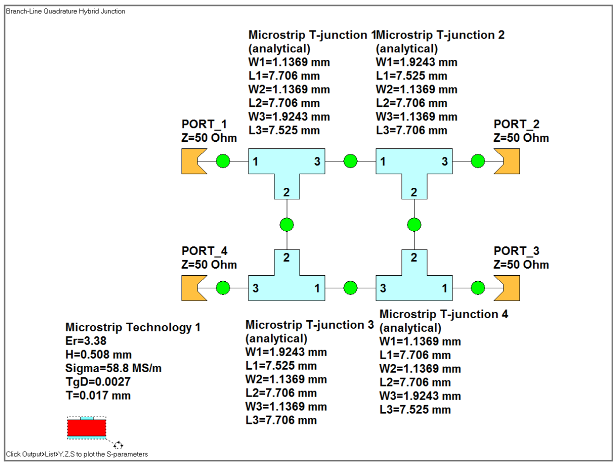

Figure 2. Microstrip circuit schematic.

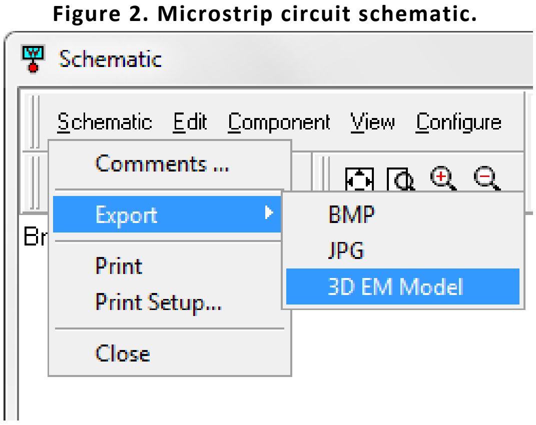

Figure 3. One mouse click transformation to EM Component.

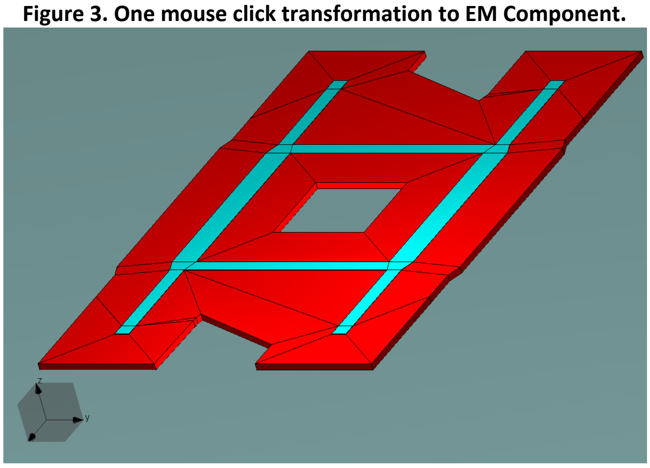

Figure 4. Exported 3D EM component.

However, for final check of the performance, 3D EM simulations of the whole circuit are required. Instead of drawing a 3D model from scratch, the user can use automatic microstrip layout to EM model export, as illustrated in Fig 2.-Fig 4.

4. Two ideal transformer elements enabling mixed-mode S parameter analysis of differential circuits

Modern microwave circuits often use differential configuration to avoid the influence of noise and interference which degrade a system performance. The analysis of such circuits is usually carried out in terms of differential and common mode S parameters. Instead of using tedious and error prone analytical conversion from single-ended to differential/common mode parameters, the later can be immediately obtained directly from circuit simulation by utilizing a pair of transformers at each side of a differential device, as shown in Fig. 5.

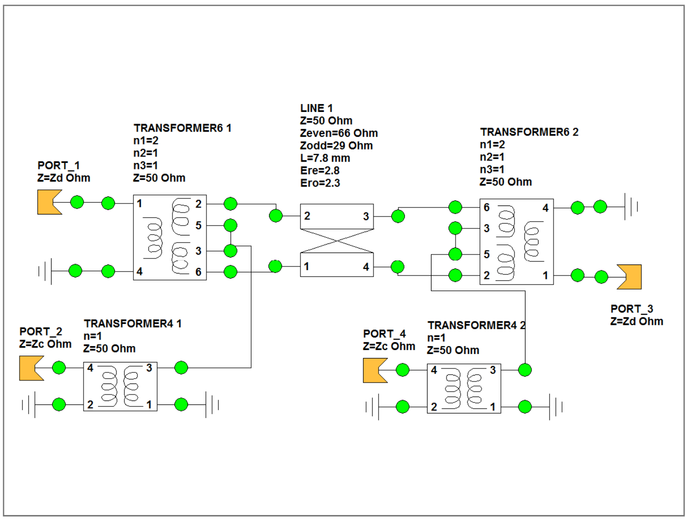

Figure 5. Differential and common mode analysis by using transformer schematic elements.

The differential S parameters are obtained at ports 1 and 3, while the common mode parameters are obtained at ports 2 and 4. Both transformer elements have been included in version 4.0.

5. General ideal coupled line element

The previous figure illustrates one more useful element introduced in the new release – a general coupled line element. The coupled line is characterized through even and odd mode characteristic impedance, even and odd mode effective dielectric constant and physical length. Such an element can be widely used when designing directional coupled line couplers and filters.

6. General power divider element

Another new element available for analyzing complex microwave circuits is a general coupler element. The same schematic element illustrated in Fig 6. can be customized to perform as quadrature (Fig. 6, on the left) or antiphase (Fig. 6, on the right) coupler. The value of the coupling can be adjusted and angles of the signal division set to appropriate values as required for the particular case of coupler opperation.

7. Four terminal transmission line elements (floating ground)

Several new ideal transmission line elements enable creation of circuits where explicit ground reference should not be used. An example of a bandstop filter with series short circuited stubs is presented in Fig. 7.

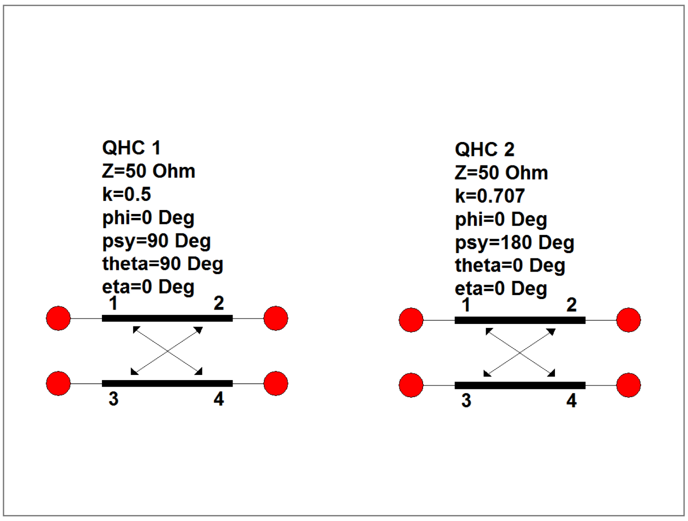

Figure 6. General coupler element configured as quadrature (on the left) and antiphase (on the right) coupler.

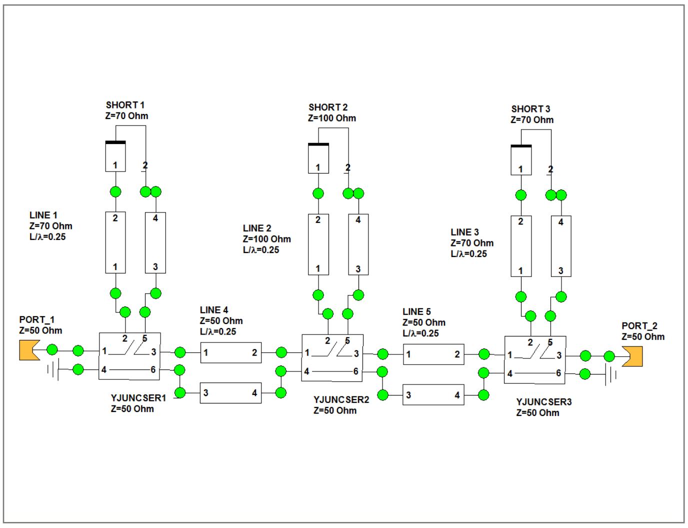

Figure 7. Band stop filter realized with floating ground components.

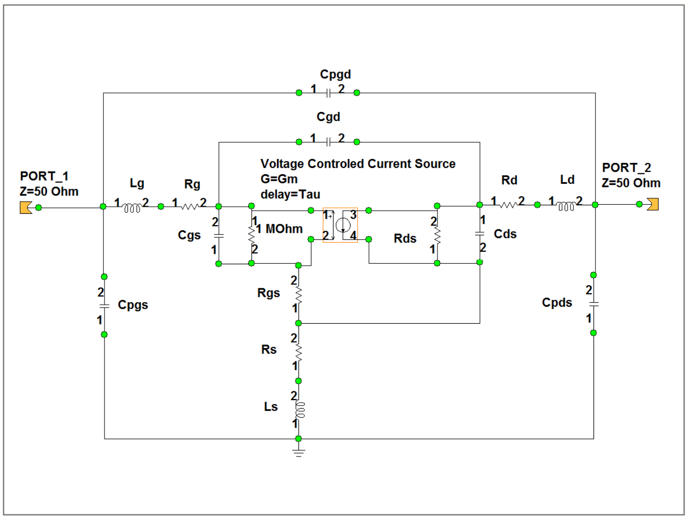

Figure 8. HEMT model utilizing voltage controlled current source with delay.

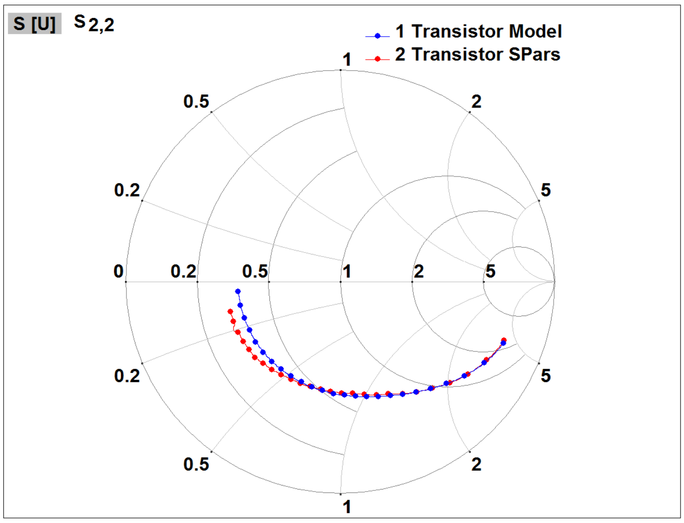

Figure 9. Comparison of S22 parameter of a HEMT device obtained by equivalent circuit model simulation and as listed in a datasheet.

8. Updated controlled sources elements with delay included

Control source elements have been updated to include time delay of the output signal with respect to the innput (control) signal. This feature is especially usefull for modeling semiconductor devices, for an example, a HEMT. An equivalent circuit model adequate for modeling HEMT devices is illustrated in Fig. 8.

Introduction of the dealy into voltage controlled current source improves accurasy of the equivalent circuit modeling as it can now properly account for an important effect caused by a delay occuring in a transistor. The comparison between S22 parameter values obtained by equivalent circuit model from Fig. 8 and S parameters supplied in datasheet, for a particular HEMT transistor, is presented in Fig. 9.

In the wide frequency range, from 2 GHz to 26 GHz, the agreement between the results is very good.