EM/Circuit Co-Simulation Made Easy and Accurate with Keysight RFPro and Modelithics Models

January 2022

Keysight Technologies' RFPro EM environment is intended to integrate electromagnetic (EM) simulation with circuit simulation, allowing for an EM simulation platform dedicated to RF/microwave circuit designs. Its goal is to make EM analysis as easy as performing circuit simulations for those who may not necessarily be dedicated EM simulation experts. On top of that, Modelithics models can be incorporated very nicely into an RFPro-based workflow, enabling you to execute painless and accurate EM/circuit co-simulations.

Historically speaking, performing an EM/circuit co-simulation has often been a task that can be rather difficult to accomplish. Cumbersome configurations and indirect workflows have been characteristics associated with these type of simulations. Unfortunately, these challenges can force you into spending a great deal of time with configuration tasks alone. To make matters worse, the process can easily lead to errors along the way.

For example, performing an EM/circuit co-simulation often required you to manually strip all circuit components from the design.1 EM ports would then have to be redefined and an EM analysis would need to be properly configured. The analysis would result in an multi-port S-parameter file that represents the passive structure. The next step would be to manually reconnect this multi-port S-parameter file to the previously stripped off components to run the EM/circuit co-simulation. Unfortunately, if you've ever had to manually connect a large number of circuit components to a multi-port passive structure, you already know that this can be a very tedious task that's also prone to errors.

The good news for you is that RFPro offers a more simple and efficient method for performing EM/circuit co-simulations. Even more good news is that Modelithics accurate models can be used very easily within RFPro. Specifically, Modelithics Microwave Global Models for RLC components are well suited for EM/circuit co-simulations, giving you the best of both worlds: EM analysis combined with accurate component models.

Let's take a quick look at how using RFPro combined with Modelithics models makes it possible to go from an initial schematic design to a final and accurate EM/circuit co-simulation in an easy and straightforward manner.

Share your feedback on this blog with the author and the Modelithics Blog Team.

Contact Us:
Modelithics, Inc.
3802 Spectrum Blvd., Suite 130
Tampa, FL 33612
blogs@modelithics.com
www.modelithics.com

About the Author

Chris DeMartino Sales & Applications Engineer, Modelithics, Inc. Chris DeMartino is a Sales and Applications Engineer at Modelithics. His experience includes developing and testing RF/microwave components and assemblies for various applications. In addition, Chris spent several years working as a technical editor for an industry publication, making him well equipped to create useful technical content. Some of his roles at Modelithics include designing application circuits, writing technical articles and application notes, and creating demonstration and tutorial videos. Chris has a B.S. in Electrical Engineering from the State University of New York at Binghamton and an M.S. in Electrical Engineering from Polytechnic University.

Have another topic that you would like Modelithics experts to cover? Email your suggestions to the **Modelithics Blog Team** and it could be featured in an upcoming post. Please include your contact information in the body of the email.

References

[1] Video, "Keysight RFPro in ADS for EM-Circuit Co-Simulation."

In Figure 1, we see a bandpass filter schematic that includes Modelithics Microwave Global Models for the AMOTECH A60L capacitor series and the Kyocera-AVX HLQ02 inductor series.
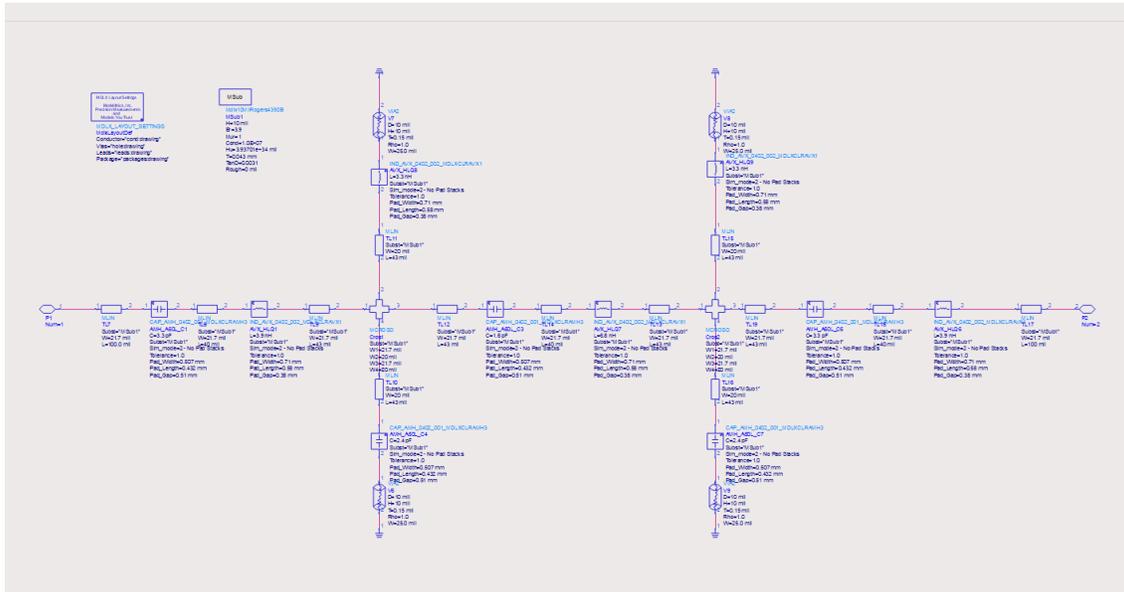

Figure 1. Bandpass filter schematic in ADS.

After creating the schematic, we can build the layout based on the schematic elements. Selecting the option for net-based connectivity lets us maintain the named nets and synchronization between the schematic and layout. Ultimately, building the layout is a simple and straightforward process. Once that's complete and the substrate has been properly configured, we can launch RFPro (Fig. 2).
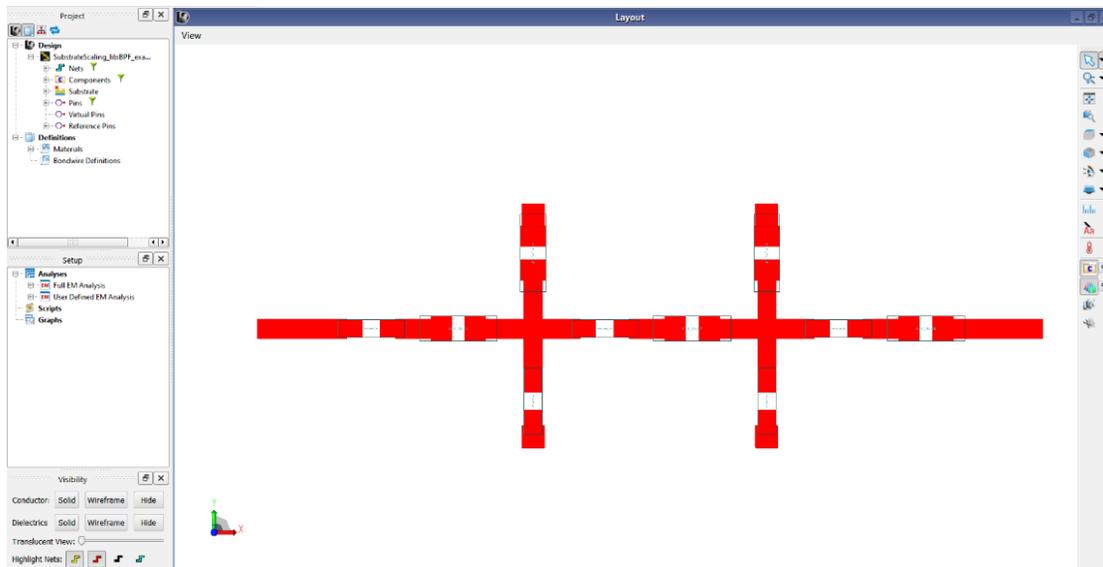

Figure 2. This is the filter design in RFPro.

Premium Model Libraries • Custom Measurement & Modeling
Test Fixtures & Accessories • Vendor Sponsored Models, Data, & Libraries

Over 20 Years of Precision Measurements and Modeling Excellence!

In the RFPro user interace, we just simply configure the ports, component models, and EM simulation settings. Following that, we can run the simulation. After the simulation is complete, we can select "Generate Sub Circuit" to create a new schematic that represents a subcircuit of the design (Fig. 3). This new schematic includes all the component models we're using along with the EM analysis data. The good news here is that it's not necessary to manually connect the component models to the EM analysis data. That's because this step has automatically been done for you. An associated symbol is also created that represents the entire subcircuit.
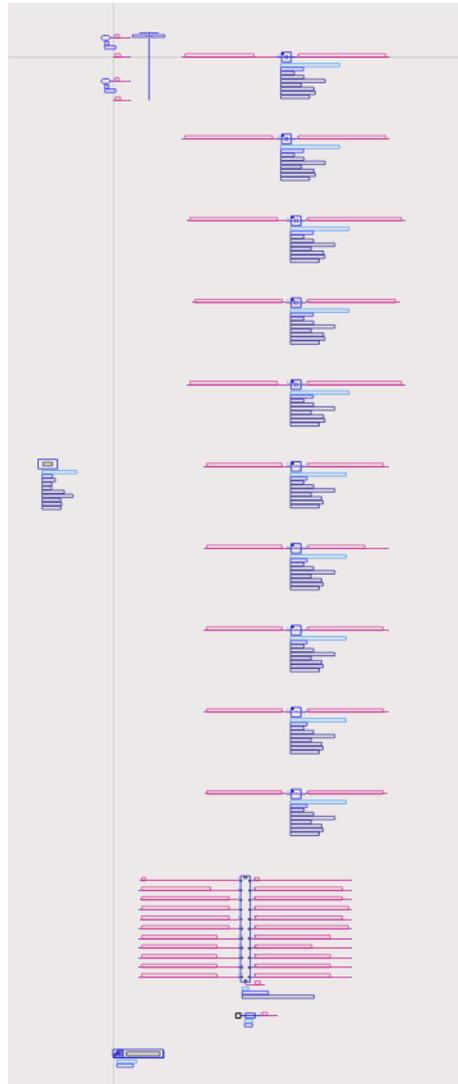

Figure 3. This schematic, which represents a subcircuit of the design, includes the Modelithics component models and the EM analysis data.

We're now ready to execute the final EM/circuit co-simulation. All we need to do is create one final schematic and then drag the symbol we just mentioned onto this schematic. Make sure that "schematic_Full_EM_Analysis" is chosen as the view for simulation. We can then simulate to perform the final EM/circuit co-simulation. Figure 4 shows the EM/circuit co-simulation results..
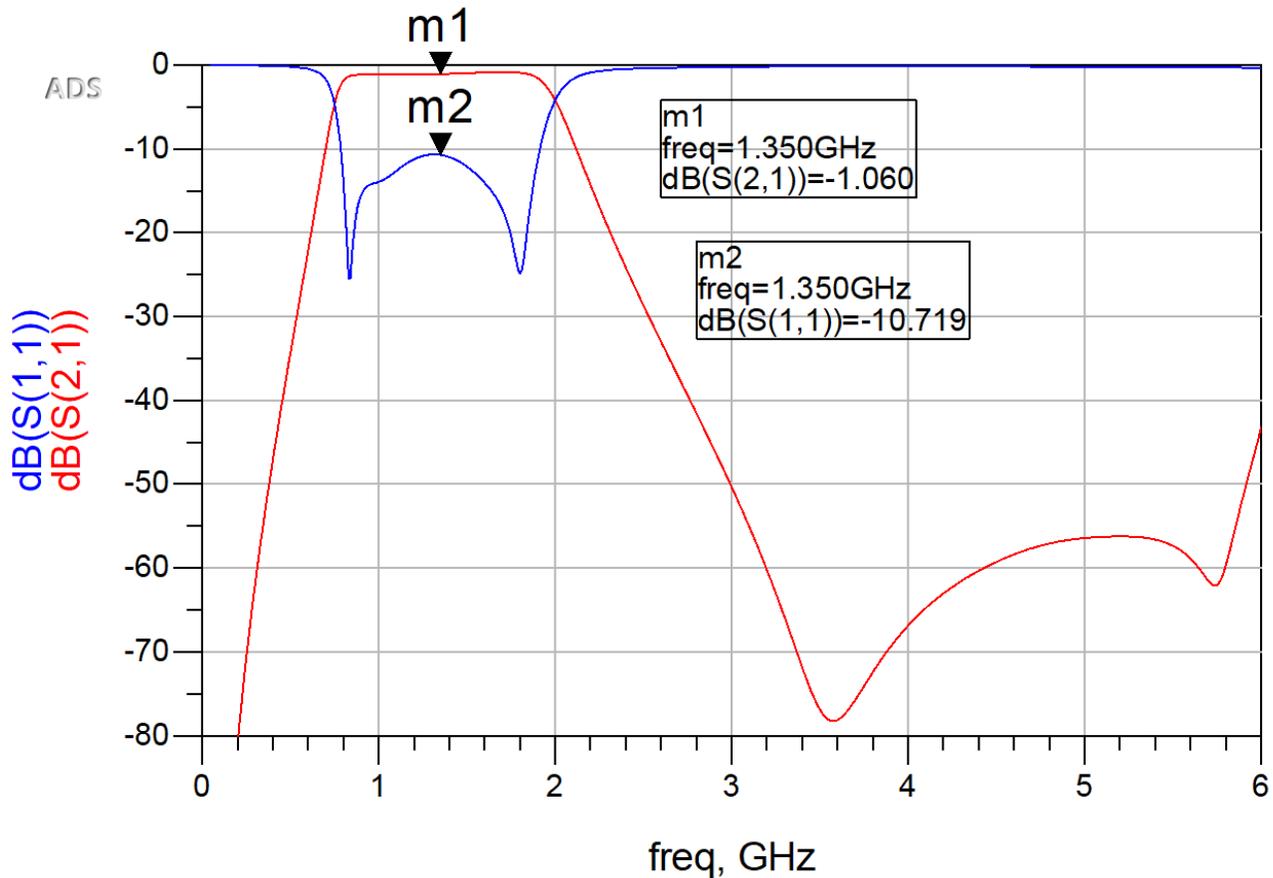
Figure 4. EM/circuit co-simulation results.

In this blog post, we've demonstrated how using RFPro combined with Modelithics models allows for a path to simple and effective EM/circuit co-simulations. We simply start with one design schematic and then work our way to an EM/circuit co-simulation in a direct manner. For a more in-depth look at this topic, be sure to sure to check out Application Note 77 from the Modelithics website titled, "Using Modelithics Models with RFPro in Keysight PathWave ADS." You can also watch the Deeper Dives and Short Waves videos on this topic.