

NEW ENHANCEMENTS FOR THE GENESYS SOFTWARE SUITE

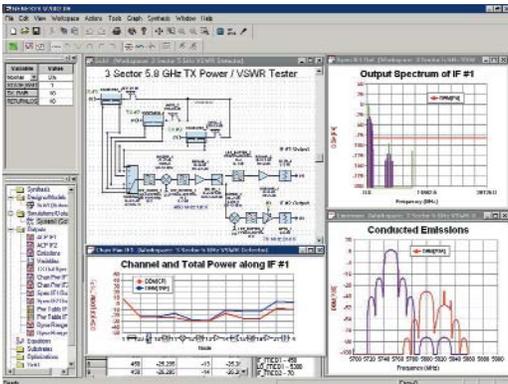
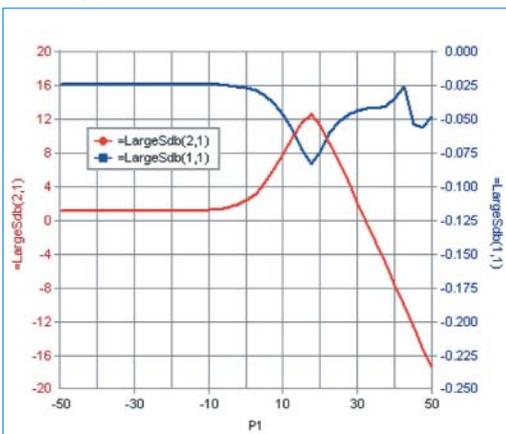


Fig. 1 S_{21} and S_{11} at 100 MHz swept vs. input drive level from -50 to $+50$ dBm for a Motorola LDMOS device. ▼



All 15 modules of the GENESYS RF/microwave design software suite have recently been enhanced. For 17 years, Eagleware has worked with thousands of customers worldwide to continuously upgrade its suite of synthesis, simulation and design environment tools. Major enhancements in the current release include new models, an antenna pattern generator for the electromagnetic simulator, large-signal S-parameter measurements, load pull support and numerous environment refinements.

GENESYS is a family name that refers to a suite of tools including schematic entry and layout, synthesis of a rich variety of circuits, circuit theory simulation, nonlinear simulation, electromagnetic simulation, and system-architecture simulation and

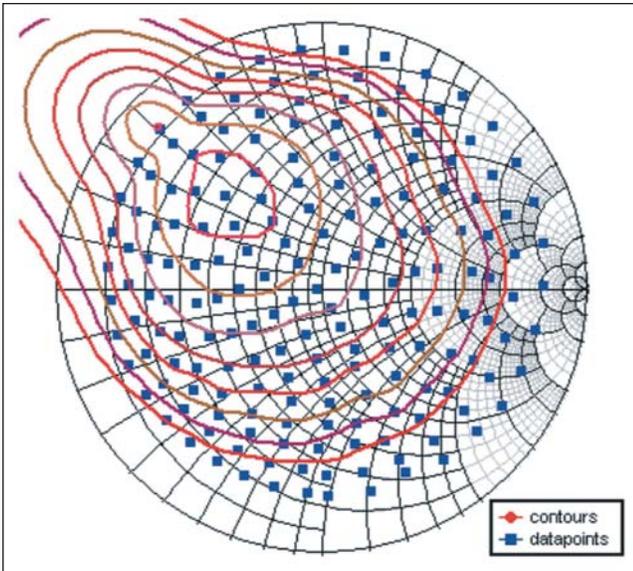
optimization. These tools have a uniform user interface, import/export capabilities and are tightly integrated for design from the top-down or bottom-up.

ENHANCEMENTS FOR POWER AMPLIFIER DESIGN

The HARBEC nonlinear simulator module of GENESYS now creates large-signal S-parameter data. Large-signal S-parameters depend upon signal magnitude, and take into account the harmonic content of the input and output signals since energy can be transferred to other frequencies in a nonlinear device. Normally, linear S-parameter data is swept versus frequency. Large-signal S-parameter data generated may be swept versus frequency at a given signal level, or may be swept versus any parameter, such as input level. **Figure 1** shows the large-signal S_{21} and S_{11} data at 100 MHz for a Motorola MRF182 LDMOS device versus input drive level from -50 to $+50$ dBm.

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▲ Fig. 2 Load pull data from a Focus Microwave file.

GENESYS now imports load pull data file standards of Maury Microwave and Focus Microwaves. Plotted in **Figure 2** are data points and contours from a Focus Microwaves file with source and load characteristic impedances of 50Ω , and a source impedance of $6.837 + j6.459 \Omega$. Gain data is used in this plot. Other parameters in the data file, including output power, efficiency and adjacent channel power (ACP), may also be plotted.

Eagleware and Motorola partnered to embed nonlinear models into GENESYS for Motorola RF LDMOS transistors. These models have been validated using large-signal S-parameter data. Currently over 50 devices in the MRF 18x, 180xx, 190xx, 191xx, 210xx, 211xx and 90xx families are included.

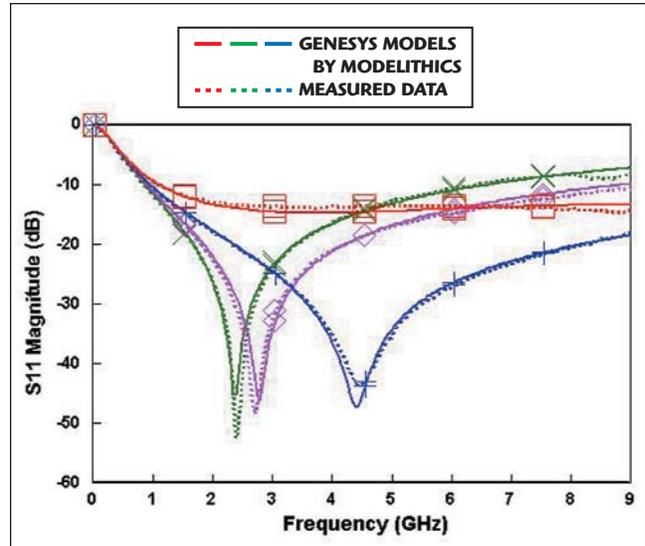
PASSIVE MODELS

The first release of the Eagleware simulator in 1985 included only basic lumped-element and electrical transmission line models. The GENESYS model set has been continually expanded and today includes thousands of models. New models include:

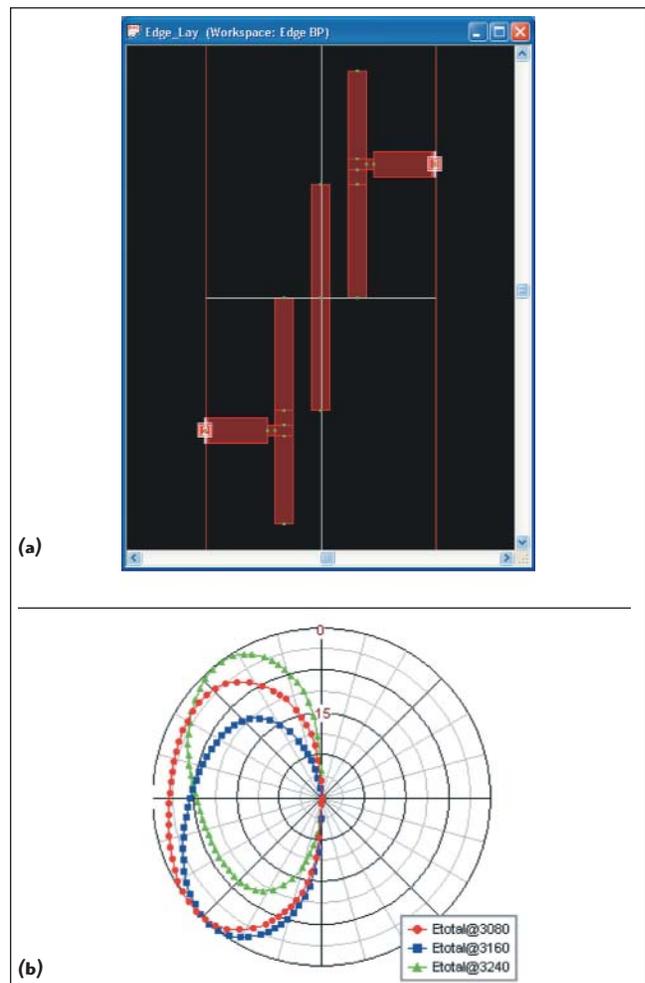
- Microstrip optimal miter arbitrary angle bend
- Microstrip asymmetric tee
- Two through 10 coupled inductors with Q
- Impedance inverter
- Frequency-independent complex-Z element
- Switch to 20 throws, with schematic updating
- SPECTRASYS frequency multiplier

S-parameter data for passive components has been available for years and component manufacturers have endeavored to remove the influence of the test fixture. But when components are mounted on a printed wiring board, the influences of board thickness and parameters are so strong that the component behavior deviates significantly from typical vendor-supplied S-parameters, even at low microwave frequencies.

Figure 3 shows the input return loss of a 4.7 pF capacitor series mounted on FR4 with thickness ranging from



▲ Fig. 3 Return loss of a 4.7 pF series capacitor on a 59 mil FR4 substrate (left resonance), a 31 mil substrate, a 14 mil substrate (right resonance) and a 5 mil substrate (no resonance).



▲ Fig. 4 Microstrip edge-coupled filter (a) and far-field total E-field radiation patterns (b) in the plane of the vertical line in the layout.

59 to 5 mils. The first series resonance varies from 2.3 GHz on 59 mil thick FR4 to 4.4 GHz on 14 mil thick FR4. On 5 mil FR4, no resonance is observed through 9

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GHz. From this data it is self-evident that a single S-parameter data file fails completely to model a component. Recognizing this, Eagleware, in conjunction with Modelithics of Tampa, FL, offers accurate substrate-dependant model libraries for a wide variety of components. The solid traces in the data plots are GENESYS model data by Modelithics and the dashed traces are measured data.

ANTENNA FIELD PATTERN VIEWER

A previous release of GENESYS pioneered co-simulation of lumped components and electromagnetic simulation. Circuits that combine distributed and lumped elements are simulated with convenience unparalleled in the industry.

GENESYS now includes a far-field antenna pattern viewer to the EMPOWER electromagnetic simulator. **Figure 4** shows the layout of a 3160 MHz edge-coupled bandpass filter and its simulated far-field pat-

terns. If this circuit is not enclosed in a covered housing then radiation can be a significant problem with more than 50 percent of the energy lost. The new EMPOWER Pattern Viewer was used to generate far-field patterns of the filter.

TEST LINK

The TEST LINK module of GENESYS automates the acquisition of data from a variety of instruments. The latest release adds support for LAN interfaces, as well as the following additional instruments:

- *Spectrum Analyzers*: Agilent E7400, L1500A; Ando AQ317; Anritsu MS2380; Rohde & Schwartz FSU
- *Network Analyzers*: Anritsu MS4630B, 54xxA series
- *Oscilloscopes*: Tektronix 11000, DSA60x; Yokogawa DL1740/DL7100/DL7200
- *Noise Figure Meters*: Agilent NFA series and HP8970B, HP85719A cards in HP859xE frames

An extensive list of supported instruments can be obtained by contacting Eagleware.

ENVIRONMENT

GENESYS includes new general features too numerous to mention. Examples include EMPOWER memory usage and dialog box improvements, user data file import plug-in capability, significant improvements to the SCHEMAX module, and improved graph title and display capabilities. Also included are LAYOUT improvements to DXF import/export, multiple layer Gerber import, and new shortcuts and clarification of M/FILTER variable labels.

For additional information on how GENESYS can accelerate and improve designs, or how to upgrade an existing GENESYS environment, please visit www.eagleware.com or contact sales@eagleware.com.

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