Optimize PSpice Designs with Measurement Data from National Instruments SignalExpress

"SignalExpress can streamline our customers' model optimization efforts in PSpice," said Greg Roberts, director of sales and marketing at EMA Design Automation. "Using SignalExpress to measure and export the data for the Optimizer in PSpice is a fast and seamless process."

Many times, theoretical models of components used in simulation tools may not yield an accurate representation of how the part actually performs in the real world. PSpice has an optional Optimizer feature that can use measurement data from physical circuits or components to optimize values of circuit designs to match the real-world response of the component. With SignalExpress, a new interactive software environment from National Instruments, design engineers can easily measure and transfer physical data to PSpice for these optimizations.

Design engineers can import physical measurement data into PSpice to optimize a model. For instance, in Figure 1, a band pass filter with center frequency of 10 KHz was designed in OrCAD Capture and simulated in PSpice. This example illustrates the process flow between design space and measurement tools.

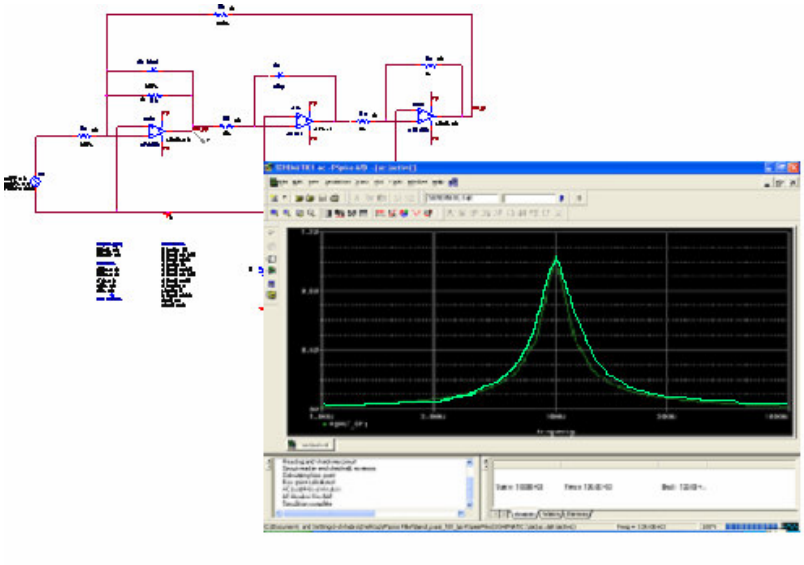

Figure 1. Circuit design entered in OrCAD capture

The project's simulation profile is set to perform an AC sweep starting at 1Hz and ending at 1 MHz. The simulation results in Figure 1 show the expected results generated from the filter simulation. At this point, design engineers build a physical prototype of the circuit and perform physical measurements to compare the actual response with this simulation.

Making a Frequency Response Measurement in SignalExpress

SignalExpress is an interactive measurement environment that design engineers can use to import design signals from simulation tools such as PSpice. With SignalExpress, design engineers can configure measurement procedures through dialogs in a drag-and-drop environment. Using this same interactive approach, SignalExpress users can create more complex measurements, such as frequency or amplitude sweeps, without programming.

Using the sweep step in SignalExpress, the design engineer can define a range of frequencies to sweep through using the NI PXI-5421 arbitrary waveform generator and measure the response of the filter to obtain the actual transfer function. The resulting measurement is displayed in Figure 2.

Optimization

Sensitivity Analysis

The engineer performs center frequency and bandwidth sensitivity analysis on the circuit components. This shows which components most affect those measurements and therefore, which components should be modified during optimization. A sensitivity analysis is particularly useful when large circuits are involved because it limits the optimization to only those components that most affect the goals.

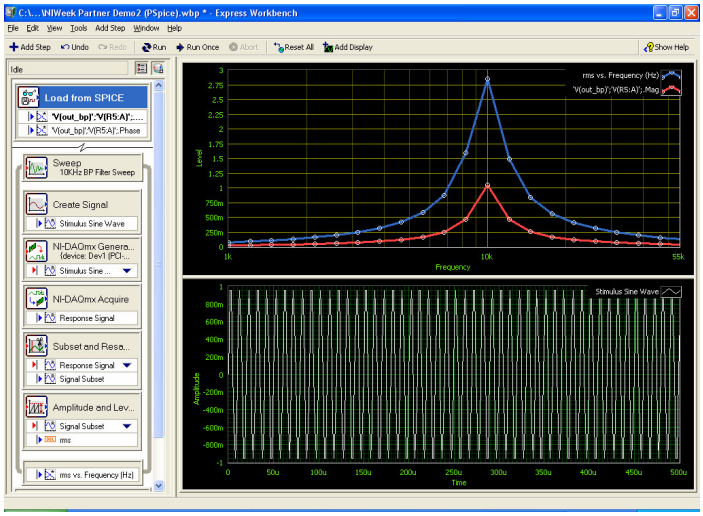

Figure 2

Optimizer

With the PSpice Advanced Analysis Optimizer, engineers can set an unlimited number of parameters and measurement-based specifications, which can be imported from PSpice. No extra work is required to set up the parameters in the schematic editor; engineers can select them from a list in the Optimizer, or send them to the Optimizer from the sensitivity analysis window or the schematic editor. Engineers also can "cross-probe" parameters from the Optimizer to find their source in the schematic.

The optimizer displays the component values and error analysis during the optimization process, and the probe window displays progress by showing movement and shaping of the simulation graph toward that of the real-world plot, as shown in Figure 3.

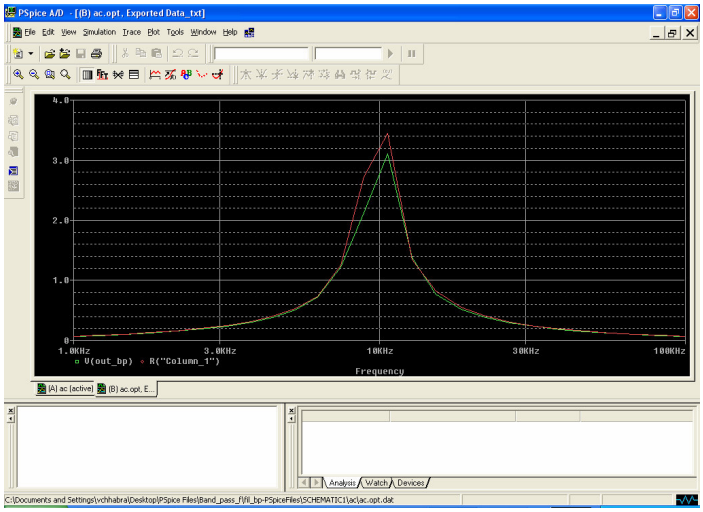

Figure 3

Engineers can use the above process to calibrate discrete circuit blocks to model the actual hardware during multiblock circuit design. This process greatly enhances design accuracy and reliability.

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