RF EDA Software Combines Simulation Capabilities with Ease-of-Design

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This article examines an RF EDA architecture designed to help engineers get their designs to market quickly, gain design expertise and learn to use different EDA technologies within their company's RF design processes. Key ingredients of this framework are application-focused design tools that narrow the gap between EDA technology and the design application. With its combination of architecture and application tools, Agilent EEsof's Advanced Design System (ADS) offers the power, expertise, and interface capability to provide a new level of ease-of-design for its users.

Design Challenges

As an RF designer, faced with deadline and cost target pressure, you may ask: Which EDA tool do I use? How do I design the circuit to my requirements? How do I apply the EDA tool to my design task? How do I verify that my design will work? The answer involves matching EDA technology to the application. This can be done through an application layer that pre-defines many of the design and simulation requirements for a specific task. It represents expert assistance to help get through the design process quickly with the best chance at a first time success. To do this successfully, the barriers to design illustrated in Figure 1 must be overcome.

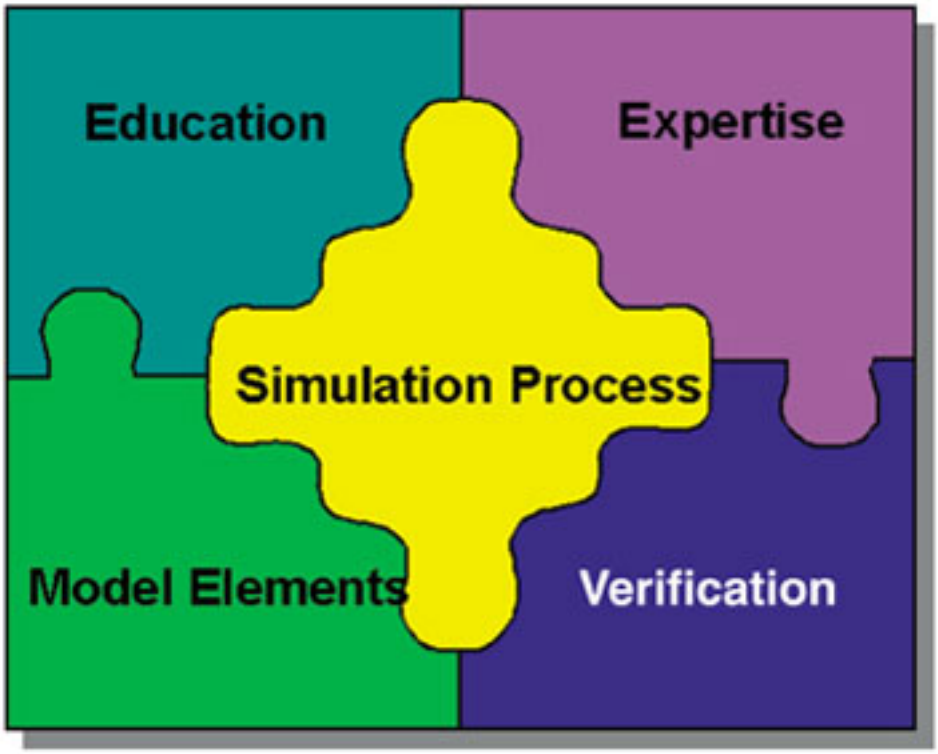

Figure 1. Design barriers that can limit first time success.

1. Education

Novice wireless engineers are challenged in their daily tasks, and senior engineers can find themselves stretched. In addition to understanding the design itself, many

RF engineers need to know more about the wireless communications standards and how they affect the design. Where do we find this type of information?
Educational material offered by the EDA vendor can address these needs with application-focused classes, design seminar material, and application notes. Seminar material and application notes are available from many EDA vendors.

2. Expertise

In RF and microwave design, there is no substitute for experience. Classroom work and technical books are helpful, but intimate knowledge of design procedures, dependencies on manufacturing processes, short cuts, and the confidence gained by experience is not easily attainable. The challenge of the EDA vendor is to provide the necessary knowledge in a form that enables immediate productivity. &quotDesign guides&quot are a solution, providing the necessary knowledge to apply the EDA software, including specialized synthesis capability, interactive design expertise and simulation test templates.

3. RF Model Elements

Simulating fully coded communication channels &quotfrom bits in to bits out&quot requires a broad range of model types. With the trend towards higher frequencies, accurate passive structure models are essential. A full set of advanced models including multi-layer, multi-coupled and electromagnetic (EM) based models are required to do high frequency passive IC or module design.
In addition to traditional passive and active models, today's communications systems also require system models. Source and behavioral building blocks are needed, along with models for propagation, noise distortions, channel coding, and the other elements that describe the signal path. Any type of meaningful verification simulation requires specific models tailored to the communications standards.

4. Fast and Powerful Simulation Process

Raw power, ease of use, and embedded expertise need to be taken as a whole to provide ease-of-design throughout the design process. Ultimately, only one thing is important: Did the tool help you achieve first time success in the fastest time possible?
When basic simulations are required, users want to quickly model and simulate an application, but for more complicated designs, leading edge simulation power is needed. To do both, a platform must combine power and flexibility by supporting PC-based and multi-processor Unix-based simulations.
Application-focused tools can perform the &quoteasy&quot tasks in design. For example, amplifier design involves analysis of gain, power output, matching, stability and spurious response. We know how it is connected and what power supplies are needed, and would rather not worry about port definitions, connection routing, frequency sweep setup and data display format. We just want to place the circuit in the simulator, select the application tests, put in the data specific to this circuit, and get results in a useable format.
In the application-focused ADS environment, a wizard-based tool allows users to easily match the power of the simulator to a particular task. With this approach, novice EDA tool users can use the IP that resides within the framework platform. The set up menu for the Smart Simulation Wizard inside ADS is shown in Figure 2. From this amplifier application window, users can quickly set up the required design and simulation parameters.

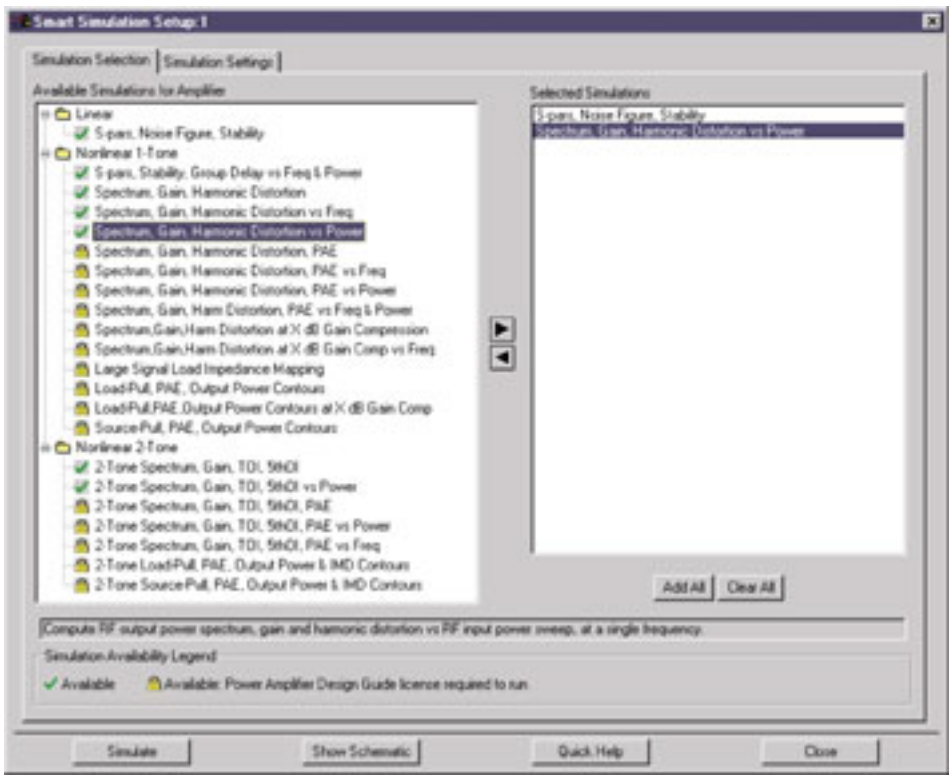

Figure 2. Smart Simulation Wizard simulation set up for an amplifier.

5. Verification

Imagine that you have completed a new Wireless LAN (WLAN) power amplifier design. How do you know that the design will work with the rest of the system and be compliant with IEEE 802.11a standards?

Verification of this type of application can be costly and tedious (but cheaper than a wasted $100k wafer run). But now, &quotdesign and verification environments&quot allow engineers to simulate a design for verification of standards compliance for spectral content, fully coded bit error rates, etc. These environments include links to instrumentation that connect the virtual design to real world hardware, allowing co-simulation for "virtual prototyping." Figure 3 shows such a design and verification setup for our WLAN amplifier.

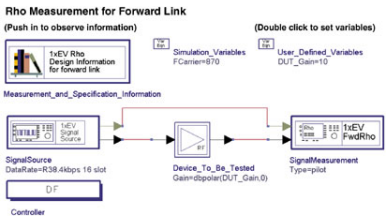

Figure 3. Design and verification environment for 1xEV Rho measurement.

Summary

Application-focused design tools help merge the simulation technology with the application at hand. By providing the education, expertise, models, simulation process, and verification environments through an application layer, engineers can quickly navigate through the most demanding communications designs. The goal, after all, of any EDA vendor is to provide ease-of-design to help customers get through the design process and achieve first pass success.

Additional information on ADS 2002 including DesignGuides, Wireless Design Libraries, design seminars, and the Smart Simulation Wizard can be found at http://www.agilent.com/find/eesof

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