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# High Frequency Engineering Keeps Getting More Complex

Gary Breed  
Editorial Director



At one time or another, we all wish we could simplify our lives. When it comes to designing and verifying the performance of a new wireless or high speed digital communications product, engineers would love to see some simplicity. Today's complex modulation formats, communications protocols and test requirements can be overwhelming.

This issue includes coverage of wireless system testing, but as noted in the Technology Report, system-level testing can no longer be separated from design and development—even at the chip level. The complexity of modern communications formats requires that every circuit and sub-circuit be tested for its effect on the rest of the system, using test signals that mimic the actual operating environment.

In the binary world of digital electronics, similar issues with complexity arose as microprocessors, digital signal processors, interface circuits and other members of the computer chip family became increasingly powerful. In that industry, the solution for dealing with complexity was automation. Fortunately, digital functionality is readily defined in mathematical terms. Those mathematical definitions may be huge, but are generally straightforward. With effective design automation, simulation and verification of digital circuits has proven to be successful.

Automation has been slower to develop for the analog/digital designs of radiowave, fiber and wireline communications. In addition to digital functionality, these systems must also consider modulation and amplification in the transmitter, signal propagation, and the receiver's signal recovery processes. Determining the appropriate mathematical definitions for these functions is a lot more complex than it is for digital logic.

Today, full automation of analog system design is finally getting close. Thanks to rapid increases in affordable computing power and continued development efforts by EDA companies, an individual engineer can now simulate and verify operation of a communications system from end-to-end, from the overall block diagram down to the device level.

This raises one more issue of complexity—the automated design tools themselves! Not just complexity in computation, but management of the design process, such as keeping track of versions, documenting design activity and sharing data among multiple networked users. If these operational complexities can be successfully incorporated, engineers will more quickly see their creative ideas turned into products.