Changing Paradigms - Fast-Turn RF and Mixed-Signal IP

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Abstract

In building communications systems-in-silicon today, the digital portions of the chip are quickly and reliably built and integrated with the use of synthesis, place and route, standard cell libraries, core processors/DSPs, and memory generators. Designs with tens of millions of transistors can be delivered in a few months. In contrast, the RF and mixed-signal components of the system are still painstakingly designed using custom methods at the transistor level. It can take from 6 to 12 months to complete one of these components of even nominal complexity. To complicate things further, they typically do not fully meet performance specifications and require a re-design.

As occurred in digital design over a decade ago, RF and mixed-signal IC product development must move to a block/cell based methodology to deal with growing complexity and shrinking design cycles. To facilitate this move, component generators that are portable and configurable across a range of specifications will become available as an indispensable enabler for designers driven to higher levels of integration.

The forces driving speedier integration are particularly acute in the exploding wireless market where RF and mixed-signal siliconization and integration are critical factors for success. The electronics in wireless communications products are dominated by RF and mixed-signal components except for the microprocessor/controller, DSP and memory. IC's that perform these RF and mixed-signal functions comprise over half of the bill of materials in cellular handsets. The pressures to integrate, reduce costs, and get to market rapidly are enormous for these applications.

In addition, industry, market and technical discontinuities and forces are changing the priorities of RF and mixed-signal designers. The emergence of RF and mixed-signal pure-play foundries is seeding a whole new crop of fabless semiconductor players. They will need to target multiple foundries and find ways to stay ahead of the accelerating technology evolution. This will drive their designers to trade-off area and performance for time-to-market and flexibility. Foundry independent design platforms together with portable and configurable RF and mixed-signal components will be key enablers for the success of these companies.

For RF and mixed-signal components, the characteristics of portability and configurability are difficult to achieve. To date, the design and process complexities of these components have resisted attempts at automation and re-use. New EDA technology (analog P&R, compaction, optimization…) is becoming available to address part of the solution. But, more importantly will be the need to couple these new tools with a significant shift in methodology (and even beliefs) to realize the dramatic increases in productivity required to meet the coming market demands. Five to ten fold design productivity improvements can be achieved (and has been demonstrated) sacrificing little in performance and silicon area. Those who adopt the new approach to RF and mixed-signal subsystem development will reap the rewards of communications product leadership. Those who refuse to make the paradigm shift in methodology will go the way of the custom logic designers of over a decade ago.