Designing High Performance Electronic Devices, Circuits and Systems

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The increasing complexity of electronic design needs to be managed with *effective optimization algorithms* and accurate statistical description of models in order to maximize the performances and the reliability of the electronic systems and minimize the tight time-to-market constraints. New optimization algorithms have to balance accuracy, robustness and computational effort. Typical electronic design problems are computationally hard and require the handling of multiple, conflicting, and non-commensurate objective functions having strong nonlinear interdependence. In this talk we present a *simulation-based multi-scenario and multi-objective optimization algorithm* for designing devices, analog mixed-signal circuits, and systems-on-chip. We express the design problems as *large-scale constrained multi-objective optimization problems* (defined in a *mixed integer-discrete-continuous domain*) for which a class of efficient algorithms has been designed and implemented. The algorithm scales gracefully with systems size and type; the framework has been tested on several real-world devices, circuits and systems. This framework satisfies the constraints, optimizes the performances while minimizes plastic/silicon area, power consumption, energy and delay maximizing the overall yield. We report on several applications of electronic system design: 1) *at the device-level*, we tackle the design of *MESFETs, MOSFETs* and *Power MOSFETs*; 2) *at the circuit-level*, we face the design of *RF Low Noise Amplifier, Leapfrog Filter, Ultra Wideband Low Noise Amplifier*, and *Fully Differential Folded-Cascode Operational Amplifiers*; 3) while *at the system-level*, we present the results for a *pipeline A/D Converter*, a *Receiver front-ends for UMTS and UWB Communications* and a *Multi Processor Systems-on-Chip*. The effectiveness and robustness of the proposed approach, as compared with the state-of-art of academic and commercial methods, are demonstrated. The results show a significant improvement in all the tackled electronic design problems.

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