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DESIGN TOOLS FOR EMERGING TECHNOLOGIES

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ABSTRACT

Integrated circuit (IC) designers make use of suites of tools in order to produce designs that routinely perform as expected when manufactured. This remarkable predictability has persisted for nearly two decades, even as fabrication technology has evolved dramatically, because the transistor has remained the fundamental building block and fabrication technology has narrowly focussed on making good transistors. For emerging applications of micro- and nanotechnology; such as photonics, sensing, chemical processing, biology, and medicine; there is far more diversity[1,2] and therefore transistor-centric design tools are of limited use. The lack of tools to develop manufacturable designs in emerging technologies has led to near decade long delays between prototype demonstration and available product, and the result has been a stifling of innovation.

One strategy for reducing these innovation-inhibiting delays is to develop algorithmic approaches that can start with first principles based descriptions of novel nanotechnology, and then rapidly and reliably synthesize manufacturable designs. Design tools are evolving this direction[3,4,5], with new extremely efficient yet customizable physical simulators, automatic paramterized low-order model extraction, and ever improving algorithms for robust optimization–new techniques that generate manufacturable designs by simultaneously optimizing system performance and robustness to manufacturing variations. In this talk we give a few examples of recent successes, and also point to unresolved challenges, in developing design tools for the rapidly expanding landscape in emerging nanotechnology.

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