# Hybrid Discrete-Continuous Computer Architectures for the post-Moore's-law Era

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Current technology trends indicate that power- and energy-efficiency will limit chip throughput in the future. I will argue that current solutions to these problems, either in the way of digital acceleration or parallel execution are very close to reaching their limits because of fundamental transistor efficiency constraints and achievable speedup due to sequential regions. A significant departure from current computing methods is required to carry forward computing advances.

In this talk, I will describe how the energy-efficiency and programmability of a large class of problems can be improved by employing a hybrid discrete-continuous model of computation instead of the ubiquitous, traditional discrete model of computation. A fundamental source of inefficiency in computing systems today is that many real-world continuous problems are artificially mapped on to the discrete execution model. We will discuss historical reasons for this approach and how the mismatch limits achievable efficiency and complicates programming. Then, drawing inspiration from the early analog computers that provided hardware primitives for continuous operations such as mathematical integration and by leveraging some features of modern digital implementations, I will discuss how on-chip analog accelerators combined with digital cores can implement the proposed hybrid discrete-continuous model and provide execution capabilities that are superior to either implementation alone.

I will present a key set of research challenges that need to be resolved to make hybrid-discrete model a reality, and the model of choice for post-Moore's-law computing.

**Biography: ---** Prof. Simha Sethumadhavan is an assistant professor of computer science at Columbia University in New York. At Columbia, he directs the computer architecture and security technologies lab (CASTL). Research at CASTL is targeted at solving two important problems that threaten to stall computing advances: energy-inefficiency and the lack of security and erosion of privacy in computing systems. Prof. Sethumadhavan obtained his PhD from UT-Austin in 2007.