ECE SEMINAR

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Circuit Innovations towards Efficient Emerging Computing Systems

ABSTRACT

Emerging computing paradigms, such as in-memory computing and quantum computing, can surpass the performance of conventional Von-Neumann computing paradigm at several orders of magnitude. Despite the great promise, the development of emerging computing systems is still at the early stage. Particularly, emerging computing systems rely on many conventional analog/mixed-signal/radio-frequency (AMS/RF) circuits to process information without delicate optimizations, leading to notable system overheads.

In this talk, I will present design innovations of two essential AMS/RF functionalities that are widely used in emerging computing systems, i.e., data convention and microwave manipulation. My methods are driven by machine learning and physical principle. With the machine learning method, I will show that we can design various learnable and efficient AMS circuits, and apply them to design high-performance in-memory computing accelerators. Based on the physical principle, I will demonstrate that we can achieve chip-based magnetic-free non-reciprocal devices which can find many applications, such as quantum computing. These circuit innovations can break the limitations of existing AMS/RF circuits, thereby having great potential to improve the performance of emerging computing systems. Finally, I will briefly discuss several interesting visions towards emerging computing systems that I want to work on inthe future.

BIOGRAPHY

Weidong Cao is currently a principal research engineer at TSMC. Before joining TSMC, he was a postdoctoral researcher at the Department of Electrical and Systems Engineering at Washington University in St. Louis (WashU). He received his Ph. D. at WashU in 2021, and his M.S. at Tsinghua University in 2016, and his B.S. at Northwestern Polytechnical University in 2013. His research interests lie in the intersection of VLSI, computer architecture, machine learning, and quantum computing. He has published tens of papers in top-tier journals and conferences, including Nature Nanotechnology, Nature Scientific Reports, AAAI, ICLR, IEEE TC, IEEE TCAD, IEEE DATE, IEEE/ACM ICCAD, DAC, ISLPED, and IEEE ISCAS. His works received multiple best paper nominations/awardee by top-tier conferences such as DAC, DATE, and ISLPED. He is also nominated to receive the 2023 outstanding Ph.D. thesis in ACM SIGDA.