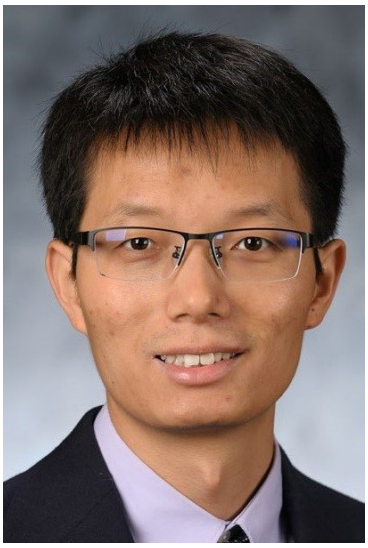
Uncertainty-Aware and Physics-Aware Data-Efficient Computational Modeling for Design Automation



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Thursday, April 18
9:30 AM
MSEE Chiminski Demonstration Space

Abstract
The design of complex integrated circuits and systems often requires high-fidelity surrogate models for efficient performance prediction and optimization. Learning these surrogate models often requires massive simulation data in the design space, especially when various uncertainties (e.g., fabrication process variations) are involved. This talk will present some data-efficient uncertainty quantification and machine learning techniques for performance prediction and design optimization. This talk will cover (1) a provable non-Monte-Carlo method to model the impact of non-Gaussian correlated process variations in IC design, (2) a novel variation-aware circuit optimization method under variation shifts, where the actual distribution of process variations is often unknown and differs from a given statistical model, and (3) physics-constraint operator learning for thermal prediction of 3D IC design.

Bio
Dr. Zheng Zhang is an Associate Professor of Electrical and Computer Engineering at University of California, Santa Barbara. He received his PhD degree in Electrical Engineering and Computer Science from MIT in 2015. His research is focused on uncertainty quantification and tensor computation for semiconductor chip design automation, and for responsible and sustainable AI systems. He is a recipient of NSF CAREER award, 3 best journal paper awards from IEEE Transactions in the EDA field, and two best dissertation awards from ACM SIGDA and MIT Microsystems Technology Labs. His work has been recognized by the IEEE CEDA Early Career Award and ACM SIGDA Outstanding New Faculty Award.

References:
[1]. C. Cui and Z. Zhang, "Stochastic collocation with non-Gaussian correlated process variations: Theory, algorithms and applications," IEEE Trans. Components, Packaging and Manufacturing Technology, vol. 9, no. 7, pp. 1362-1375, July 2019. (Yearly Best Paper Award)
[2] Y. Pan, Z. He, N. Guo and Z.Zhang, "Distributionally Robust Circuit Design Optimization under Variation Shifts," submitted to International Conference on Computer-Aided Design (ICCAD) 2023.
[3] Z. Liu, Y. Li, J. Hu, X. Yu, Xin Ai, Z. Zeng, and Z. Zhang, "DeepOHeat: Operator learning-based ultra-fast thermal simulation in 3D-IC design," ACM/IEEE Design Automation Conference (DAC), PP. 1-6, San Francisco, CA, June 2023.

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