

The New Microelectronics Revolution and Arizona State University's Leadership in Research and Education

Abstract:

Around two years ago, President Biden signed the CHIPS and Science Act, which provides over \$50 billion for American semiconductor research, development, manufacturing, and workforce development. In response, major semiconductor companies such as Micron, Qualcomm, and GLOBALFOUNDRIES have committed an additional \$50 billion for chip manufacturing in the US. These investments are in addition to TSMC's ongoing efforts in building state-of-the-art fabs in Arizona. These developments provide an unprecedented opportunity for university research, university/industry partnerships, and educational initiatives for workforce development in microelectronics. In this talk, I will first describe efforts at Arizona State University to build a microelectronics manufacturing ecosystem Hub and recent success stories. I will next provide an overview of my own research on various aspects of design-for-testability of 3D integrated circuits, silicon lifecycle management, and hardware security. Finally, I will discuss some open problems and challenges in a broader context. These are unprecedented times for microelectronics research in the US, and ASU is at the forefront of this revolution, with endless opportunities for graduate students and researchers.

KRISHNENDU CHAKRABARTY

Krishnendu Chakrabarty received the B. Tech. degree from the Indian Institute of Technology, Kharagpur, and the M.S.E. and Ph.D. degrees from the University of Michigan, Ann Arbor. He is now the Fulton Professor of Microelectronics in the School of Electrical, Computer and Energy Engineering at Arizona State University (ASU) and Chief Technology Officer (CTO) of the Department of Defense Microelectronics Commons Southwest Advanced Prototyping (SWAP) Hub. He is also the Director of the ASU Center on Semiconductor Microelectronics. Before joining ASU, he was the John Cocks Distinguished Professor and Department Chair of Electrical and Computer Engineering (ECE) at Duke University.



Prof. Chakrabarty is a recipient of the National Science Foundation CAREER award, the Office of Naval Research Young Investigator award, the Humboldt Research Award from the Alexander von Humboldt Foundation, Germany, the IEEE Transactions on CAD Donald O. Pederson Best Paper Award (2015), the IEEE Transactions on VLSI Systems Prize Paper Award (2021), the ACM Transactions on Design Automation of Electronic Systems Best

Paper Award (2017), multiple IBM Faculty Awards and HP Labs Open Innovation Research Awards, and over a dozen best paper awards at major conferences. He is also a recipient of the IEEE Computer Society Technical Achievement Award (2015), the IEEE Circuits and Systems Society Charles A. Desoer Technical Achievement Award (2017), the IEEE Circuits and Systems Society Vitold Belevitch Award (2021), the Semiconductor Research Corporation Technical Excellence Award (2018), the Semiconductor Research Corporation Aristotle Award (2022), the IEEE-HKN Asad M. Madni Outstanding Technical Achievement and Excellence Award (2021), and the IEEE Test Technology Technical Council Bob Madge Innovation Award (2018). He is a Research Ambassador of University of Bremen (Germany) and he was a Hans Fischer Senior Fellow at the Institute for Advanced Study, Technical University of Munich, Germany during 2016-2019. He is a 2018 recipient of the Japan Society for the Promotion of Science (JSPS) Invitational Fellowship in the “Short Term S: Nobel Prize Level” category. He is a recipient of the Distinguished Alumnus Award from the Indian Institute of Technology, Kharagpur.

Prof. Chakrabarty’s current research is in the areas of design-for-test of 3D integrated circuits and heterogeneous integration, AI accelerators, microfluidic biochips, hardware security, and AI for healthcare. He has collaborated extensively with the semiconductor industry and his test technology inventions have been adopted by Intel, TSMC, Samsung, NXP, Mentor Graphics, and Qualcomm (<https://www.src.org/award/tech-excellence/2018/>). He was a Visiting Professor at NVIDIA for seven months during 2022-2023. He has supervised 44 completed PhD dissertations and mentored 12 postdoc researchers.

Prof. Chakrabarty is a Fellow of ACM, IEEE, and AAAS, and a Golden Core Member of the IEEE Computer Society. He was a member of the DARPA Microsystems Exploratory Council during 2022-2023. He is a member of the Scientific Advisory Board of the Deutsches Forschungszentrum für Künstliche Intelligenz (German Research Center for Artificial Intelligence). He was a Distinguished Visitor of the IEEE Computer Society (2005-2007, 2010-2012), a Distinguished Lecturer of the IEEE Circuits and Systems Society (2006-2007, 2012-2013), and an ACM Distinguished Speaker (2008-2016). Prof. Chakrabarty served as the Editor-in-Chief of *IEEE Design & Test of Computers* during 2010-2012, *ACM Journal on Emerging Technologies in Computing Systems* during 2010-2015, and *IEEE Transactions on VLSI Systems* during 2015-2018.