Northeastern
SMART Center

2021 Seminar Series –

THE COMING TOGETHER OF SILICON CIRCUITS AND AI FOR NEXT GENERATION WIRELESS COMMUNICATIONS, IOT, AND QUANTUM APPLICATIONS

Dr. Subhanshu Gupta

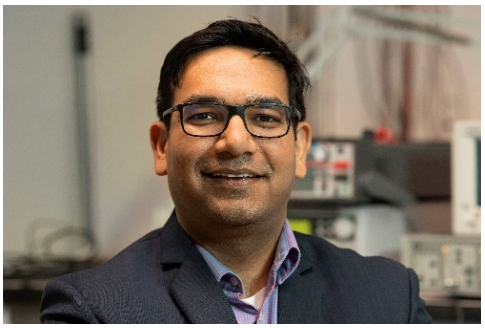
Abstract: The ubiquity of silicon-based devices around us have paved the way for fast communications, personalized healthcare, and terabits/sec computing unthinkable few decades ago. The question of what's next for silicon-based circuits and systems gets interesting with the end (or as some say, slowing) of technology scaling but the emphasis on wireless infrastructure, internet-of-things, and quantum computing leveraging advances in Artificial Intelligence (AI) has brought forward several new fundamental challenges. This talk will harness recent research in silicon-based circuits and systems and AI to bridge the fundamental gap in the underlying physics of large-scale wireless communications and cryogenics harmoniously with the outside environment.

The first part of the talk will present reconfigurable spatial signal processors for large-scale antenna arrays that can achieve unprecedented resolution both in near-field and far-field. Introducing discrete-time delay compensating techniques with large range-to-resolution ratios and AI-optimized radio front-end solutions, we will demonstrate high data-rates with wide modulated bandwidths suited to 5G/Beyond-5G wireless communications. The second part of the talk will present AI optimizers to solve practical issues in well-known high-speed and high-resolution superconducting/quantum circuits for the first time. We will look into the design of an energy-efficient and low-latency optimizer that greatly reduces the calibration time and enabling heterogeneous cryogenic platforms coupling speed and energy-efficiency of Josephson Junctions with area-efficiency of CMOS. The third part of the talk will present silicon-based systems-on-chip that enables large-scale IoT networks combining advances in self-powered radios with energy harvesters tapping into the surrounding environments.

We will conclude this talk with custom integrated cryoelectronics and multi-antenna testbeds for modeling and design of high-speed cryoelectronic processors and spatial signal processors with diverse spatial functions such as beam training and RFI cancellation for future quantum computing and distributed antenna arrays of tomorrow.

Time: 1:00 - 2:20 pm, January 26th, Tuesday, 2021

Virtual:
Join by Zoom: https://northeastern.zoom.us/j/99690083544



Dr. Subhanshu Gupta received the B.E. degree from the National Institute of Technology (NIT) at Tiruchirappalli, Tiruchirappalli, India, in 2002, and the M.S. and Ph.D. degrees from the University of Washington, Seattle, WA, USA, in 2006 and 2010, respectively. He is currently an Assistant Professor of electrical engineering and computer science with Washington State University, Pullman, WA, USA. He has held industrial positions at Maxlinear (Irvine, CA) where he worked on wideband transceivers for SATCOM and infrastructure applications.

Subhanshu is a recipient of the National Science Foundation CAREER Award in 2020, the Department of Defense DURIP award in 2021, and the Cisco Faculty Research Award in 2017. He and his group has also been nominated and awarded multiple student awards including Analog Devices Outstanding Student Designer Award in 2008, the IEEE RFIC Symposium Best Student Paper Award (third place in 2011 and nominee in 2020), and the IEEE Applied Superconductivity Conference (nominee in 2020). Subhanshu serves as an Associate Editor for the IEEE Transactions on Circuits and Systems – I for the term 2020-21 and also served as a guest editor for *IEEE Design & Test of Computers* in 2019. His research interests include large-scale phased arrays and wideband transceivers, low-power time-domain circuits and systems, and statistical hardware optimization for next-generation wireless communications, internet-of-things, and quantum applications.