

Title:

CMOS cryogenic controller chips for next generation scalable quantum computers.

Abstract:

Quantum computers have unparalleled potential in exponentially speeding up intractable computing problems including secure communication, meteorology, drug discovery and so on. Superposition combined with quantum phenomenon of entanglement enables quantum computers to perform vast complex computation at unmatched speed and makes it fast enough to outpace even today's state-of-the-art supercomputers by several orders. However, a fault tolerant quantum computer requires at least a million qubits, and it is not trivial to scale up today's room temperature qubit control technology to this extent. This talk will give an overview of recent trends in quantum computing control hardware for two of the most promising solid-state qubits sought after by industry, i.e. spin and superconducting qubits. This talk will discuss state-of-the-art controller chips operating at cryogenic temperatures necessary to control multiple qubits paving the way for realizing a scalable quantum computer.

Bio:

Dr. Mustafijur Rahman is an Assistant Professor in the Department of Electrical Engineering at IIT Delhi. His research interest is in the field of RF/millimeter-wave IC design for cryogenic controller ICs for quantum computing, 6G and automotive RADARs. Prior to joining IIT Delhi, he was a Research Scientist at Intel Labs, Hillsboro, USA where he worked on advanced transceivers in CMOS at RF/mm-wave frequencies for 5G and cryogenic controller hardware for quantum computing. He has also worked at Qualcomm Atheros, San Jose, USA in the WiFi product design team. He completed his MS and PhD in Electrical Engineering at University of Minnesota, Twin Cities, USA in 2014 and 2016 respectively and B.Tech. in Electronics & Communication Engineering at NIT Silchar, India in 2009. He is the recipient of the Teaching Excellence Award 2023 at IIT Delhi, University of Minnesota Doctoral Dissertation Fellowship 2015, the Best in Session Awards at TECHCON 2014, 2015, and 2016, and the Gold Medal for the Best Engineering Graduate in 2009 at NIT Silchar. He is a senior member of the IEEE.