Ultrafast Time Domain Cryogenic CMOS Device Characterization Platform for Quantum Computing Applications

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Abstract

Cryogenic electronics have a wide range of applications, ranging from quantum information science to extra-terrestrial electronics to gravitational wave research to high performance computing. However, the dominant application leading the way for cryogenic electronics research, is quantum computing where electronic functionality at the 4 K or below has become a requirement. The most promising candidate to fulfil this functionality without disturbing the cryogenic environment with a path to large-scale integration is CMOS. Therefore, a lot of effort has been put in to hunt for the right CMOS device technology and obtain their low temperature models for designing reliable and accurate cryogenic circuits. Though it has been acknowledged that precise characterization is crucial for reliable low power and low temperature circuit design, obtaining reliable device characterization and reliability at low temperatures has not been sufficiently addressed. Absent specially is the time domain characterization of devices which are crucial for designing accurate analog circuitry. This webinar will review the challenges of using cryogenic CMOS in the field of quantum computing and further discuss the motivation for creating cryogenic ultra-fast time domain device characterization setup for accurate high-performance cryogenic CMOS circuit design.

Bio:

Pragya R. Shrestha is a research associate in the Nanoscale Processes and Measurements Group in the Nanoscale Device Characterization Division at the National Institute of Standards and Technology (NIST). She received her Electrical Engineering PhD degree (2013) from Old Dominion University. Her current research work includes developing innovative electrical device characterization techniques for novel devices. The device characterization mainly focuses on low temperature and ultra-fast measurements to understand device physics and reliability. She is also involved in developing the highly sensitive ESR (Electron Spin Resonance) technique relevant to a broad spectrum of material system which is otherwise difficult to realize using conventional ESR setup with a high-Q resonator.