University of Pittsburgh | School of Computing and Information

Proposal Defense

Doctor of Philosophy in Information Science with a Focus in Telecommunications

"Toward Scalable Distributed Fault-Tolerant Quantum Computing" by **Nitish Chandra**

Date: Friday, October 30, 2026
Time: 3 to 5 p.m.
Place: Room 828, Information Sciences Building, 135 N. Bellefield Ave Pittsburgh, PA 15260

Committee:

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Abstract:
Large-scale fault-tolerant quantum computing will require quantum error correction, efficient logical operations, and architectures capable of scaling beyond the capacity of individual quantum processors. Distributed fault-tolerant quantum computing (d-FTQC) offers a promising approach by interconnecting smaller quantum processing units (QPUs), but it also introduces challenges in maintaining reliable and efficient computation under the constraints imposed by the QPUs, quantum switches, and interconnects. This dissertation investigates how quantum error-correcting codes, networked architectures, and logical operations can be jointly designed and analyzed to address these challenges. It will study quantum low-density parity-check (qLDPC) and topological codes to examine how code partitioning, nonlocal syndrome extraction, and interconnect noise affect decoding and logical error performance. These investigations will characterize how network design and system constraints influence the feasibility and performance of distributed quantum computation. The dissertation will also develop network-aware compilation and scheduling strategies for logical qubits distributed across multiple processors. Analytical modeling and numerical simulation will be used to evaluate logical error rates and error accumulation. They will also be used to assess execution latency, communication overhead, and resource requirements. Informed by advances in trapped-ion and neutral-atom architectures and quantum interconnect technologies, this dissertation aims to develop and evaluate methods for scalable distributed fault-tolerant quantum computing.