CSEE QUANTUM COMPUTING INITIATIVE

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Our work in quantum computing has focused on how quantum computing and classical computing can be used together to solve extremely computationally hard problems. We have directed our attention on what does quantum computing bring to solving problems from a computer science view point rather than a strictly physics view point. Quantum computing sees the solution space from a more global perspective while classical computing sees the space more locally. Our approach is to bring the two perspective together so that the quantum is utilized to home in on the solution globally while the classical zeros in on a more accurate localization of the solution. To attain this goal we have studied the practical properties of adiabatic quantum computing and gate/circuit model quantum computing. We have succeeded in improving the solution to problems that can be expressed as Ising or QUBO problems with error correction or mitigation techniques that use classical computing to enhance the quantum computing results.

Deepinder Sidhu, Ph.D.

Quantum security research focuses on major topics including classical cryptography, quantum postulates, qubits and quantum gates, quantum entanglement, reversible computation, quantum circuits, quantum algorithms, quantum key distribution, quantum-resistant cryptography and quantum Internet protocols and applications.

Curtis Menyuk, Ph.D.

Microresonators for signal processing in quantum optical networks

It will be necessary to create optical networks that can link quantum computers together while maintaining entanglement. In particular, it will be necessary to create add-drop multiplexers that can switch signal wavelengths while maintaining entanglement. Microresonators have demonstrated the capability of doing that. A key issue that has not been resolved in laboratory experiments to date is the impact of noise on these devices and the systems that rely on them. In the computational photonics laboratory, we have been studying microresonators for a variety of applications with support from the National Science Foundation, the Army Research Laboratory, and the Air Force Office of Scientific Research. Characterizing the noise limitations and overcoming them is a common feature of all these applications, including quantum signal processing applications.