

NY CREATES Emerging Technologies Seminar Series

May 20th (Wednesday), 2020: 11:30 am – 12:30 pm

Advance Zoom Registration Required at:

<https://us02web.zoom.us/meeting/register/tZYsduCgqzooHtyKN6beOJu7cVF9ozCazw8d>

“Digital Quantum Computing Based on Superconducting Electronics”

by: Dr. Oleg Mukhanov

(Co-CEO, CTO & Co-Founder, Seeqc Inc., Elmsford, NY)

Abstract: While the quantum computing field has made major advances in recent years, it continues to face challenges that affect stability and scalability, cost per qubit, readout and control issues, excessive input/output connection count. Current systems rely on analog qubit readout and control delivered via coaxial cabling and other external hardware. A new approach to quantum computing which addresses these challenges will be described. Our approach - digital quantum computing - combines quantum and classical computing using co-located cryogenic processors. It utilizes SFQ digital pulses instead of microwave pulses for qubit control and readout. The SFQ based Digital Quantum Management (DQM) system-on-a-chip provides scalable qubit readout and control by eliminating expensive and cumbersome coaxial cabling. The co-located in the same cryostat superconducting classical SFQ co-processors can operate at tens of GHz. This enables new functionalities in quantum algorithms and making quantum error-correction practical.



Biography: Oleg Mukhanov has more than 30 years of experience in superconducting electronics and is recognized as a leader in the field. Prior to founding Seeqc, for 27 years Oleg held roles of increasing responsibility at Hypres, the world leader in high-performance superconducting electronics. He joined Hypres to initiate the development of Rapid Single Flux Quantum (RSFQ) superconductor circuit technology, which he co-invented in 1985 while a PhD student at Moscow State University. Over the years at Hypres, Oleg demonstrated a number of world-record-setting digital circuits. He also initiated and led many projects on high-performance superconductor digital, mixed signal, and analog circuits based on RSFQ logic and its derivatives.

Oleg co-invented and led the development of a new generation of energy-efficient single flux quantum (SFQ) technology and superconducting ferromagnetic and superconducting spintronic random-access memories for energy efficient computing systems. He also co-invented a Digital-RF architecture and led the development of the cryocooled Digital-RF receiver system based on RSFQ logic – the world’s first commercial-grade use of superconducting digital technology.

From 2005-2007, Oleg was president of the US Committee on Superconducting Electronics. He was a long-time editor of the IEEE Transactions of Applied Superconductivity journal and received an IEEE outstanding service recognition as an editor of special issues. Oleg is a Fellow of IEEE, active in the IEEE Quantum Future Directions Initiative, and a member of the American Physical Society. He is the recipient of The IEEE Award for Continuing and Significant Contributions in the Field of Small Scale Applied Superconductivity. Oleg has authored and co-authored over 200 scientific papers, book chapters, and patents. Oleg earned a PhD in physics from Moscow State University and an MS (with honors) in electrical engineering from Moscow Engineering Physics Institute.