भारतीय विज्ञान संस्थान
INDIAN INSTITUTE OF SCIENCE

IAP SEMINAR SERIES

Department of Instrumentation & Applied Physics

DEPARTMENT OF INSTRUMENTATION AND APPLIED PHYSICS



Talk Title:

Quantum Approximate Optimization Algorithms for QUBO Problems Across Quantum Hardware Platforms: Performance Analysis, Challenges, and Strategies

Abstract

Quantum computers are expected to offer advantages in solving optimization problems that are challenging for classical computers. Quadratic Unconstrained Binary Optimization (QUBO) problems represent an important class of problems with applications in finance and logistics. The Quantum Approximate Optimization Algorithm (QAOA) is a prominent candidate for solving QUBO problems on near-term quantum devices. In this talk, I will introduce QAOA and its variants using a financial feature-selection problem as an example. I will then explore the performance of standard QAOA and its variant, ADAPT-QAOA. Our results show that ADAPT-QAOA can substantially outperform standard QAOA on harder problem instances, while standard QAOA remains competitive on simpler problems. I will discuss these results across different problem sizes and hardness levels, highlighting the performance differences between the two approaches.

Beyond algorithmic performance, I will examine the practical challenges of implementing QAOA on current quantum hardware. Using hardware calibration data, we compare superconducting and trapped-ion platforms in terms of estimated execution times and error rates. The analysis highlights an important trade-off between speed and error rate and demonstrates why hardware-aware considerations are essential when evaluating the practical potential of QAOA for optimization problems.

Overall, the talk will provide a perspective on both the algorithmic and hardware aspects of QAOA, connecting the performance of the algorithms considered with the practical challenges of implementing them on current quantum computers. The results highlight the trade-offs that need to be considered when evaluating the potential of QAOA on near-term quantum hardware.

This talk is based on the preprint:

Teemu Pihkakoski, Aravind Plathanam Babu, Pauli Taipale, Petri Liimatta, and Matti Silveri, "Evaluating the Quantum Approximate Optimization Algorithms for QUBO Problems Across Quantum Hardware Platforms: Performance Analysis, Challenges, and Strategies," arXiv:2510.12336 (2025).

About the Speaker



Mr. Teemu Pihkakoski

Senior PhD STUDENT,
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Mr. Teemu Pihkakoski is a senior PhD student in the SuperQ group at the Nano and Molecular Systems Research Unit, University of Oulu. He completed his bachelor's degree at the University of Oulu in 2022 and his master's degree at the University of Oulu in 2024, and continued his doctoral research under the supervision of Associate Professor Matti Silveri. Teemu's work focuses on quantum optimization algorithms such as QAOA, evaluating their performance on various quantum hardware platforms, and studying and modeling the magnitude and spatial dependence of crosstalk in superconducting quantum computers.

Date
7TH OCTOBER 2026

Time
3 PM

Venue
S V Narasaiah Auditorium, IAP Department

Online Seminar

All are welcome!

Refreshments will be served after the seminar.