Optimization in the Cloud - Solving Combinatorial Optimization Problems in Industry with Nature-Inspired and Hybrid Quantum Algorithms

MARTIN SCHUETZ

November 15, 2022 to November 29, 2022
15:00 to 17:00
Blue Lecture Room

The lectures will be held in the **BLR** on **November 15** & **17, 10:00** to **12:00** and **ONLINE** on November **22** & **29** from **15:00** to **17:00**.

Abstract
The Amazon Quantum Solutions Lab is a team of research scientists whose mission is to help our customers accelerate their understanding and use of quantum computing. In this series of presentations I will showcase a few examples how we leverage quantum and related advanced algorithms to solve some of our customers' hardest problems, designing and building quantum computing, machine learning and optimization solutions on AWS. Examples include combinatorial optimization with physics-inspired graph neural networks [Nature Machine Intelligence **4**, 367 (2022)], and robot motion planning with nature-inspired random-key algorithms [arXiv:2206.03651].

In **part 1 (introduction)**, we will discuss networks, graphs, and canonical graph-based optimization problems such as maximum cut or the maximum independent set problem. As potential solution strategies we will then highlight nature-inspired, physics-inspired, quantum-inspired, and quantum-native algorithms. Finally, we discuss some of the shortcomings of some of these approaches.
In **part 2 (graph neural networks)**, we focus on physics-inspired graph neural networks as a novel, hybrid approach to solve combinatorial optimizations problems at scale, with millions of variables. We will show how to apply this tool to the famous graph coloring problem, with important applications in scheduling and assignment problems.
In **part 3 (random-key algorithms)**, we will provide an introduction to random-key algorithms and show how these can be used to solve a plethora of sequencing-type problems such as the traveling salesman problem, vehicle routing problems and robot motion planning problems.

Lecturer

Martin is a Sr. Research Scientist at the Amazon Quantum Solutions Lab. Martin has worked several years as an academic researcher with a focus on quantum simulation and quantum optics, at ETH Zurich, the Max-Planck-Institute for Quantum Optics and Harvard University. Today Martin is working with customers to help solve some of their hardest problems, designing and building quantum computing, machine learning and optimization solutions on AWS.?

Participation is open to all ICFOnian

We strongly encourage you to attend the lectures in person on November 15&17.

In case you are unable to attend in person, please, use the following link, which will be available also on November 22 & 29:

ID MEETING: 847 9467 9413

ACCESS CODE: 095215

Hosted by: Academic Affairs