# Ruslan Shaydulin

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## Profile

PhD candidate in computer science, expecting to graduate in May 2020. My research focusses around the intersection between (hyper)graph problems, optimization, machine learning, quantum and high-performance computing. I have extensive experience designing and implementing hybrid quantum-classical algorithms, with particular interest in variational and decomposition-based approaches (including multilevel).

## Peer-reviewed Publications

Ruslan Shaydulin, Yuri Alexeev. Evaluating Quantum Approximate Optimization Algorithm: A Case Study. In Proceedings of the 2nd International Workshop on Quantum Computing for Sustainable Computing (QCSC 2019) (in conjunction with 10th International Green and Sustainable Computing Conference (IGSC 2019)) (to appear), 2019

Sami Khairy, **Ruslan Shaydulin**, Lukasz Cincio, Yuri Alexeev, Prasanna Balaprakash. Reinforcement Learning for Quantum Approximate Optimization. *Research Poster, accepted at Supercomputing '19*, 2019

Ruslan Shaydulin, Ilya Safro, and Jeffrey Larson. Multistart Methods for Quantum Approximate Optimization. In *Proceedings of 2019 IEEE High Performance Extreme Computing Conference (HPEC) (to appear), 2019*Best Student Paper Finalist. Preprint: arXiv:1905.08768

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Christian F.A. Negre, Ilya Safro, Susan M Mniszewski, and Yuri Alexeev. A Hybrid Approach for Solving Optimization Problems on Small Quantum Computers. *Computer*, 52(6):18-26, 2019. Cover Feature. DOI: 10.1109/MC.2019.2908942

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Ilya Safro, Susan Mniszewski, and Yuri Alexeev. Network Community Detection on Small Quantum Computers. *Advanced Quantum Technologies*, 2(9):1900029, 2019. DOI: 10.1002/qute.201900029

Ruslan Shaydulin, Hayato Ushijima-Mwesigwa, Ilya Safro, Susan Mniszewski, and Yuri Alexeev. Community Detection Across Emerging Quantum Architectures. In *Proceedings of the 3rd International Workshop on Post Moore's Era Supercomputing (in conjunction with Supercomputing '18)*, 12-14, 2018. Preprint <a href="mailto:arXiv:1810.07765">arXiv:1810.07765</a>

Ruslan Shaydulin and Ilya Safro. Aggregative Coarsening for Multilevel Hypergraph Partitioning. *In Proceedings of 17th International Symposium on Experimental Algorithms (SEA 2018)*, 103:2:1-2:15, 2018.

DOI: 10.4230/LIPIcs.SEA.2018.2

Ruslan Shaydulin, Jie Chen, and Ilya Safro. Relaxation-Based Coarsening for Multilevel Hypergraph Partitioning. *Multiscale Modeling & Simulation*, 17(1):482-506, 2019. DOI: 10.1137/17M1152735

# Online Preprints and In-Submission Works

Justin Sybrandt, Ruslan Shaydulin, Ilya Safro. Hypergraph Partitioning With Embeddings. In submission.

Preprint: arXiv:1909.04016

Ruslan Shaydulin, Caleb Thomas, Paige Rodeghero. Making Quantum Computing Open: Lessons from Open-Source Projects. Preprint: <a href="mailto:arXiv:1902.00991">arXiv:1902.00991</a>

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**Ruslan Shaydulin**, Justin Sybrandt. To Agile, or not to Agile: A Comparison of Software Development Methodologies. Preprint: <a href="mailto:arXiv:1704.07469">arXiv:1704.07469</a>

## Education

## Clemson University, SC

Spring 2020 (expected)

PhD candidate in Computer Science, advisor: Ilya Safro

Research in algorithms, high performance computing, big data analysis and quantum computing

Relevant coursework: Design & Analysis of Algorithms, Data Mining, Distributed & Cluster Computing, Parallel

Architecture, Network Science

## **Moscow Institute of Physics and Technology**

Summer 2016

Department of Control and Applied Math,

Bachelor of Science in Applied Mathematics and Physics

Minor: Computer Science and Data Analysis

# Work Experience

## Research Aide, Argonne National Laboratory

Summer 2018, 2019

- Developed quantum-accelerated frameworks for network community detection and graph partitioning under the supervision of Yuri Alexeev
- Co-authored 4 papers on quantum optimization (3 first author)
- Contributed to multiple proposals

#### Research Intern, Parallels LABs

Winter 2014 - Summer 2016

- Improved stability and security of SmartMail macOS email client by isolating potentially unstable parts as separate services
- Added features to UI of iQuickMark iOS app

## Contributed Talks and Posters

## SIAM Conference on Parallel Processing for Scientific Computing (PP20)

Feb 12-15, 2020

Seattle, WA

Gave talk "Multilevel Hybrid Quantum-Classical Algorithms on Graphs"

#### **Chicago Quantum Exchange Meeting**

June 12, 2019

**University of Chicago** 

Presented poster "Practical Quantum Approximate Optimization"

## SIAM Conference on Computational Science and Engineering (CSE19)

Feb 25-28, 2019

Spokane, WA

Presented poster "Quantum Local Search for Graph Community Detection"

# **Quantum Computing Tutorial**

Dec 10-11, 2018

**Argonne National Laboratory** 

Gave talk "QAOA Algorithm Introduction"

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## **Quantum Computing Workshop**

Jul 25-27, 2018

#### **Argonne National Laboratory**

Presented preliminary results on "Machine Learning on Near-Term Quantum Computers"

## 32nd Clemson Mini-Conference on Discrete Mathematics and Algorithms

Nov 4, 2017

#### **Clemson University**

Presented poster "Relaxation-Based Coarsening for Multilevel Hypergraph Partitioning"

#### 58th Scientific Conference

Nov 23-28, 2015

## Moscow Institute of Physics and Technology

Gave talk "IPC (Inter-Process Communication) in OS X"

# Leadership and Service

## SIAM Conference on Parallel Processing for Scientific Computing (PP20)

Feb 12-15, 2020

#### Seattle, WA

Led and co-organized a minitutorial "Combinatorial Optimization on Quantum Computers"

## SIAM Conference on Parallel Processing for Scientific Computing (PP20)

Feb 12-15, 2020

#### Seattle, WA

Co-organized a minisymposium "Recent Advances and Trends in Hybrid Quantum-Classical Algorithms"

## **Quantum Computing Tutorial**

May 14, 2019

#### **Argonne National Laboratory**

Led and co-organized a hands-on tutorial for Qiskit, a framework for quantum computing

#### **Mathematics Teacher, Summer School**

Summer 2014

## Kostroma, Russia

School administrator, organized extracurricular activities.

## Teaching

### **Network Science CPSC 8480**

Fall 2018, 2019

#### **Clemson University**

Teaching Assistant responsible for grading and answering students' questions during office hours

## Design and Analysis of Algorithms CPSC 8400

Spring 2019

## **Clemson University**

Teaching Assistant responsible for grading and answering students' questions during office hours

#### Algorithms and Data Structures CPSC 2120

Spring 2019

#### Clemson University

Teaching Assistant responsible for running the lab section, grading and answering students' questions during office hours

# Mathematics Teacher, Summer School for Middle- and High-School students

Summer 2014

#### Kostroma, Russia

Created and taught a course on basics of graph theory, combinatorics and number theory.

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# Languages and Technologies

C, Python

Prior experience: C++, MATLAB, Objective-C, Swift, Bash, IBM QISKit Limited prior experience: R, SQL, yacc, bison, AWS, Google Cloud Engine

Technologies and tools: Git, Xcode for iOS/OSX UI/Backend, TCP/IP, UNIX/Linux, MPI

## Honors and Awards

- Best Student Paper Finalist at IEEE HPEC 2019 (results to be announced at the conference), recipient
- Upsilon Pi Epsilon CS Honor Society, member
- Supercomputing '19 Student Volunteer Travel award, recipient
- SIAM CSE '19 Broader Engagement Travel award, recipient
- Clemson CCIT Supercomputing '17, '18 and '19 travel award, recipient
- Clemson Graduate Travel Grant, Spring '19, recipient
- Moscow Institute of Physics and technology Abramov scholarship Top 300 students in the university, based on high academic achievement, *recipient*