

# 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).

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## 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](https://arxiv.org/abs/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](https://doi.org/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](https://doi.org/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 [arXiv:1810.07765](https://arxiv.org/abs/1810.07765)

**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](https://doi.org/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](https://doi.org/10.1137/17M1152735)

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## Online Preprints and In-Submission Works

Justin Sybrandt, **Ruslan Shaydulin**, Ilya Safro. Hypergraph Partitioning With Embeddings. *In submission*.  
Preprint: [arXiv:1909.04016](https://arxiv.org/abs/1909.04016)

**Ruslan Shaydulin**, Caleb Thomas, Paige Rodeghero. Making Quantum Computing Open: Lessons from Open-Source Projects. Preprint: [arXiv:1902.00991](https://arxiv.org/abs/1902.00991)

Ruslan Shaydulin, Justin Sybrandt. To Agile, or not to Agile: A Comparison of Software Development Methodologies.  
Preprint: [arXiv:1704.07469](https://arxiv.org/abs/1704.07469)

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## 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

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## 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
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## 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](#)"

**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"

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## 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.

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## 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.

## 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

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## Honors and Awards

- International Green and Sustainable Computing Conference (IGSC 2019) student travel award, *recipient*
- 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*