

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

Sami Khairy, **Ruslan Shaydulin**, Lukasz Cincio, Yuri Alexeev, Prasanna Balaprakash. Reinforcement-Learning-Based Variational Quantum Circuits Optimization for Combinatorial Problems. *Accepted for Poster Presentation at the Machine Learning and the Physical Sciences workshop at Conference on Neural Information Processing Systems (NeurIPS 2019)*, 2019

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
Preprint: [arXiv:1910.04881](https://arxiv.org/abs/1910.04881)

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)*, 2019
Best Student Paper (of ~50 student papers). 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)

Online Preprints and In-Submission Works

Hayato Ushijima-Mwesigwa, **Ruslan Shaydulin**, Christian F. A. Negre, Susan Mniszewski, Yuri Alexeev, Ilya Safro. Multilevel Combinatorial Optimization Across Quantum Architectures. *In submission*. Preprint: [arXiv:1910.09985](https://arxiv.org/abs/1910.09985)

Zirou Qiu, **Ruslan Shaydulin**, Xiaoyuan Liu, Yuri Alexeev, Christopher S. Henry, Ilya Safro. Network Alignment by Propagating Reliable Similarities. *In submission*.

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)

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 6 papers on quantum optimization and machine learning (5 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

Summer 2018

Contributed Talks and Posters

International Green and Sustainable Computing Conference (IGSC 2019) Alexandria, VA

Oct 22, 2019

Presented poster "Reinforcement Learning for Quantum Approximate Optimization"

Chicago Quantum Exchange Meeting <i>University of Chicago</i> Presented poster "Practical Quantum Approximate Optimization"	June 12, 2019
SIAM Conference on Computational Science and Engineering (CSE19) <i>Spokane, WA</i> Presented poster " Quantum Local Search for Graph Community Detection "	Feb 25-28, 2019
Quantum Computing Tutorial <i>Argonne National Laboratory</i> Gave talk " QAOA Algorithm Introduction "	Dec 10-11, 2018
Supercomputing '18 <i>Dallas, TX</i> Gave talk "Community Detection Across Emerging Quantum Architectures" at Clemson booth	Jul 25-27, 2018
Quantum Computing Workshop <i>Argonne National Laboratory</i> Presented preliminary results on " Machine Learning on Near-Term Quantum Computers "	Jul 25-27, 2018
32nd Clemson Mini-Conference on Discrete Mathematics and Algorithms <i>Clemson University</i> Presented poster "Relaxation-Based Coarsening for Multilevel Hypergraph Partitioning"	Nov 4, 2017
58th Scientific Conference <i>Moscow Institute of Physics and Technology</i> Gave talk "IPC (Inter-Process Communication) in OS X"	Nov 23-28, 2015

Leadership and Service

SIAM Conference on Parallel Processing for Scientific Computing (PP20) <i>Seattle, WA</i> Led and co-organized a minitutorial " Combinatorial Optimization on Quantum Computers "	Feb 12-15, 2020
SIAM Conference on Parallel Processing for Scientific Computing (PP20) <i>Seattle, WA</i> Co-organized a minisymposium "Recent Advances and Trends in Hybrid Quantum-Classical Algorithms"	Feb 12-15, 2020
Quantum Computing Tutorial <i>Argonne National Laboratory</i> Led and co-organized a hands-on tutorial for Qiskit, a framework for quantum computing	May 14, 2019
Mathematics Teacher, Summer School <i>Kostroma, Russia</i> School administrator, organized extracurricular activities.	Summer 2014

Teaching

Network Science CPSC 8480 <i>Clemson University</i> Teaching Assistant responsible for grading and answering students' questions during office hours	Fall 2018, 2019
Design and Analysis of Algorithms CPSC 8400 <i>Clemson University</i> Teaching Assistant responsible for grading and answering students' questions during office hours	Spring 2019
Algorithms and Data Structures CPSC 2120 <i>Clemson University</i> Teaching Assistant responsible for running the lab section, grading and answering students' questions during office hours	Spring 2019

Mathematics Teacher, Summer School *Kostroma, Russia*

Summer 2014

Created and taught a course on basics of graph theory, combinatorics and number theory to middle and high school students.

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

- International Green and Sustainable Computing Conference (IGSC 2019) student travel award, *recipient*
- Best Student Paper at IEEE HPEC 2019 (of ~50 student papers), *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*