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 arXiv: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

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: arXiv:1902.00991

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Ruslan Shaydulin, Justin Sybrandt. To Agile, or not to Agile: A Comparison of Software Development Methodologies. Preprint: arXiv: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 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*