Martin Suchara

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RESEARCH AREAS

- Quantum error correction, noise mitigation, and modeling of open quantum systems
- Quantum communication and applications in distributed computing, sensing, and security
- Scalable simulations of quantum communication networks and quantum circuits

EDUCATION

Princeton University, Ph.D. in Computer Science	*2011*
Princeton University, M.A. in Computer Science	*2008*
California Institute of Technology, B.S. with Honor in Computer Science	*2006*

CITIZENSHIP: U.S. Citizen

PROFESSIONAL EXPERIENCE

Argonne National Laboratory – Computational Scientist RD3. Develop and lead research projects in quantum computing and quantum networking. Apply technical expertise to develop new advanced quantum technologies. Ensure program growth, secure funding and participate in strategic planning with laboratory leadership.	*2018–present*
University of Chicago – Scientist and Ph.D. advisor at the Pritzker School of Molecular Engineering. Advise graduate students and perform research on joint research projects.	*2018–present*
AT&T Labs Research – Principal Inventive Scientist. Developed a new research program in quantum networking and advised management on the role of quantum technologies in telecommunications.	*2015–2018*
IBM T. J. Watson Research Center – Postdoctoral Scholar in the Theory of Quantum Computing and Information Group. Developed new quantum error-correcting codes and performed their numeric evaluations on an IBM Blue Gene supercomputer.	*2013–2015*
University of California Berkeley – Postdoctoral Scholar at the Berkeley Quantum Information & Computation Center. Took ownership of part of an IARPA funded research project, mentored students, performed technical work, and presented results to program managers.	*2011-2013*

AWARDS AND HONORS

- **Best Paper Awards:**
  - Best Paper Award at the IEEE International Conference on Quantum Computing and Engineering for work on simultaneous measurements for VQE [8], 2020
  - IBM Q Best Paper Award for work on minimizing state preparations in VQE [30], 2019
  - Best Student Paper Award at ACM Sigmetrics for work on network architecture for joint failure recovery and traffic engineering [16], 2011

- Impact Argonne Award from Laboratory Director Paul Kearns for notable achievement through Extraordinary Effort, 2020
- Elevated to IEEE Senior Member grade, 2020
- Gordon Wu Fellowship, awarded to 15 students in the School of Engineering at Princeton, 2006-2010
- Upper Class Merit Award for academic achievement and research, Caltech, 2005-2006
- Patricia B. Conklin Scholarship for academic achievement, Caltech, 2004-2005 and 2005-2006
- Marcella and Joel Bonsall Technical Writing Prize, 2005
- Arthur Rock SURF Fellowship, undergraduate research award, 2005
- Fulbright Travel Grant to U.S.A., 2003
- Bronze Medal, 15th International Young Physicists' Tournament, 2002

PH.D. STUDENTS, POSTDOCTORAL AND RESEARCH ADVISEES

- Dr. Pranav Gokhale, CRI postdoctoral fellow, 2020 – present
- Dr. Zain Saleem, postdoctoral scholar, 2019 – present
- Kaiwen Gui, Ph.D. candidate, primary advisor 2019 – present
- Xiaoliang Wu, Ph.D. candidate and QISE-NET fellow, co-advisor 2019 – present
- Alexander Kolar, undergraduate research aide, 2019 – present
- Nathan White, undergraduate research aide, 2020 – present

SHORT-TERM VISITORS

- Dr. Eugene Ching Wang, software developer contractor, June – August 2019
- Bilal Tariq, visiting Ph.D. student from SUNY Buffalo, June – August 2020
- James Williams, visiting Ph.D. student from Caltech, June – August 2020
- Teague Tomesh, visiting Ph.D. student from Princeton, June – August 2019 and June – August 2020
- Bradley Pearlman, visiting Ph.D. student from University of Colorado – Boulder, June – August 2019
- Wei Tang, visiting Ph.D. student from Princeton, June – August 2019

GRANTS AND CONTRACTS AWARDED

- "Q-NEXT: Next Generation Quantum Science and Engineering," September 2020 – September 2025, Thrust Lead, DOE SC (DE-FOA-0002253), total budget $115M (SC) + 93M (partners), budget for my thrust from DOE $12.7M.
- "QLCI-CI: Hybrid Quantum Architectures and Networks (HQAN)," September 2020 – August 2025, Co-PI, NSF (19-559), total budget $25M, budget for my group $512.5K.
- "Variational Monte-Carlo-inspired Quantum Algorithms for Many-body Systems and Combinatorial Optimization," September 2020 – August 2022, Co-PI, NSF (20-056), total budget $300K, budget for my group $150K.
- "Cooperative Research and Development Agreement (CRADA) with Super.Tech Labs, Inc.," July 2020 – July 2022, Lead PI, DOE SC and in-kind contribution, total budget $250K (SC) + 176K (in kind), budget for Argonne $426K.
- "Quantum Device Simulator," October 2020 – September 2022, Lead PI, FACCTS, total budget $40K, budget for Argonne $40K.
- "Hybrid Quantum-Classical Computing Architectures," January 2019 – December 2020, Lead PI, LDRD, total budget $500K, budget for Argonne $500K.
- "Investigating Quantum Chemistry Circuits with OpenFermion," April 2019 – September 2019, Lead PI, LDRD Advanced Computing Expedition, total budget $37.5K, budget for Argonne $37.5K.
- "A Scalable Toolkit for Noisy-Qubit Simulation," September 2019 – September 2020, Co-PI, LDRD, total budget $240K, budget for Argonne $240K.

- "Quantum Computing for Fusion Energy Materials," September 2019 – September 2021, Co-PI, DOE FES (LAB 19-2078), total budget $2,214K, budget for Argonne $545K.
- "Advancing Integrated Development Environments for Quantum Computing through Fundamental Research (AIDE-QC)," September 2019 – September 2024, Co-PI, DOE ASCR (LAB 19-2081), total budget $23.25M, budget for Argonne $3M.
- "Efficient Quantum Computing," August 2018 – August 2021, Lead PI, LDRD, total budget $1,366K, budget for Argonne $1,366K.

RESEARCH COMMUNITY LEADERSHIP AND SERVICE

Service to Argonne National Laboratory:
- Member of the QIS Incubator team as an advisor to the Laboratory Director in 2019-2020. Helped develop a strategy for submission of NQI Research Center proposal. This effort culminated in successful funding of the Q-NEXT Research Center that received $115M from the U. S. Department of Energy and $93M from partner institutions.
- QIS Working Group Steering Committee member representing the CELS Directorate at Argonne, with responsibility to help set up collaborations, organize seminars, investigate research directions, and collect funding agency plans.

Conference and Workshop Organization:
- Organizer, Birds-of-a-Feather session on Quantum Information Science Activities at Argonne, IEEE International Conference on Quantum Computing and Engineering – QCE20, October 2020
- Organizer, Quantum Computing Workshop, Discovery Partners Institute, January 2020
- Organizer, Quantum Networking Workshop, Discovery Partners Institute, October 2019
- Organizer, QIS Student Workshop for Argonne summer students, August 2019 and August 2020
- Organizer, Quantum Information Science Workshop, Argonne, September 2019

Working Groups and Workshop Reports:
- Co-author of the Quantum Internet Blueprint Workshop report titled "From Long-distance Entanglement to Building a Nationwide Quantum Internet", February 2020.
- Member of the IEEE Framework for Metrics and Benchmarks of Quantum Computing working group

Peer Reviewing and Refereeing:
- Editorial Board Member: Section "Applied Physics" in the journal Applied Sciences, an SCIE-indexed, peer-reviewed, open access journal
- Program Committee Member: International Conference on Systems and Networks Communications (ICSNC 2011)
- External Reviewer: npj Quantum Information; Physical Review Letters; Physical Review A; Communications of the ACM; IEEE Transactions on Very Large Scale Integration Systems; IEEE Transactions on Parallel and Distributed Systems; IEEE/ACM Transactions on Networking; ACM SIGCOMM CCR; Optimization and Engineering, Springer; Software: Practice and Experience, Wiley; Computer Communications, Elsevier; Computer Networks, Elsevier; Journal of Computer Networks and Communications, Hindawi; IEEE/ACM ISCA 2013; ACM SIGCOMM 2011; NSDI 2011, 2010, 2009; IEEE ICFIN 2009; International Conference on High Performance Scientific Computing

Proposal Reviews:
- DOE SBIR/STTR Quantum Technologies Panel, November 2018 and January 2020
- DOE Career-Net-Science Panel, May 2019

PUBLICATIONS

More than 50 publications and 1,250 citations in total, with an H-index 17 (Google scholar).
Book Chapters:

1. B. Wydrowski, S. Hegde, **M. Suchara**, R. Witt and S. Low, "Grid Networks and TCP Services, Protocols, and Technologies." In Grid Networks: Enabling Grids with Advanced Communication Technology, F. Travostino, J. Mambretti, G. Karmous-Edwards (Eds.), John Wiley & Sons, Ltd., 2006, ISBN: 0-470-01748-1.

Refereed Journal Articles:

2. M. Perlin, Z. Saleem, **M. Suchara** and J. Osborn. "Quantum Circuits: Divide and Compute with Maximum Likelihood Tomography." npj Quantum Information – Nature journal, to appear, 2021.

3. P. Gokhale, O. Angiuli, Y. Ding, K. Gui, T. Tomesh, **M. Suchara**, M. Martonosi and F. Chong. "O(N3) Measurement Cost for Variational Quantum Eigensolver on Molecular Hamiltonians." IEEE Transactions on Quantum Engineering, Vol. 1, pp. 1-24, 2020.

4. **M. Suchara**, A. Cross and J. Gambetta, "Leakage Suppression in the Toric Code." Quantum Information and Computation, Vol. 15, No. 11 & 12, pp. 0997-1016, 2015.

5. S. Bravyi, **M. Suchara** and A. Vargo, "Efficient Algorithms for Maximum Likelihood Decoding in the Surface Code." Physical Review A 90, Vol 90, No. 3, pp. 032326, 2014.

6. C. Lai, G. Paz, **M. Suchara** and T. Brun, "Performance and Error Analysis of Knill's Postselection Scheme in a Two-Dimensional Architecture." Quantum Information and Computation, Vol. 14, No. 9 & 10, pp. 807-822, 2014.

7. S. Bravyi, G. Duclos-Cianci, D. Poulin and **M. Suchara**, "Subsystem Surface Codes with Three-Qubit Check Operators." Quantum Information and Computation, Vol. 13, No. 11 & 12, pp. 0963, 2013.

8. **M. Suchara**, S. Bravyi and B. Terhal, "Construction and Noise Threshold of Topological Subsystem Codes." Journal of Physics A: Mathematical and Theoretical, Vol. 44, No. 15, pp. 155301, 2011. **Paper included in the Highlights of 2011 Collection.**

9. I. Avramopoulos and **M. Suchara**, "Protecting DNS from Routing Attacks: A Comparison of Two Alternative Anycast Implementations." IEEE Security & Privacy, Vol. 7, No. 5, pp. 14-20, 2009.

Papers in Refereed Conference or Workshop Proceedings:

10. W. Tang, T. Tomesh, J. Larson, **M. Suchara** and M. Martonosi. "CutQC: Using Small Quantum Computers for Large Quantum Circuit Evaluations." In proceedings of the ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2021.

11. P. Gokhale, O. Angiuli, Y. Ding, K. Gui, T. Tomesh, **M. Suchara**, M. Martonosi and F. Chong, "Optimization of Simultaneous Measurement for Variational Quantum Eigensolver Applications." In proceedings of the IEEE International Conference on Quantum Computing and Engineering - QCE20, October 2020. **Winner of the Best Paper Award.**

12. T. Ayral, F-M. Le Régent, Z. Saleem, Y. Alexeev and **M. Suchara**, "Quantum Divide and Compute: Hardware Demonstrations and Noisy Simulations." In proceedings of the IEEE Computer Society Annual Symposium on VLSI, July 2020.

13. Z. Saleem, K. Gui, R. Shaydulin and **M. Suchara**, "Comparing Constrained and Unconstrained Quantum Approximate Optimization Algorithms." In proceedings of the 2nd International Workshop on Quantum Resource Estimation QRE 2020, collocated with ISCA, May 2020.

14. X. Wu, J. Chung, A. Kolar, E. Wang, T. Zhong, R. Kettimuthu and **M. Suchara**, "Simulations of Photonic Quantum Networks for Performance Analysis and Experiment Design." In proceedings of the PHOTONICS workshop, collocated with SC19, November 2019.

15. X. Wu, J. Chung, A. Kolar, E. Wang, T. Zhong, R. Kettimuthu and **M. Suchara**, "Photon-Level Simulation of Quantum Key Distribution with Picosecond Accuracy." In the 2019 Single Photon Workshop, October 2019.

16. **M. Suchara**, Y. Alexeev, F. Chong, H. Finkel, H. Hoffmann, J. Larson, J. Osborn, and G. Smith, "Hybrid Quantum-Classical Computing Architectures." In proceedings of the 3rd International Workshop on Post-Moore Era Supercomputing, collocated with SC18, November 2018.

17. **M. Suchara**, A. Cross and J. Gambetta, "Leakage Suppression in the Toric Code." In Proceedings of the IEEE International Symposium on Information Theory, June 2015.

18. **M. Suchara**, A. Faruque, C. Lai, G. Paz, F. Chong and J. Kubiatowicz, "QuRE: The Quantum Resource Estimator Toolbox." In Proceedings of IEEE International Conference on Computer Design, October 2013.

19. **M. Suchara,** D. Xu, R. Doverspike, D. Johnson and J. Rexford, "Network Architecture for Joint Failure Recovery and Traffic Engineering." In Proceedings of ACM SIGMETRICS, June 2011. **Winner of the Best Student Paper Award.**

20. **M. Suchara**, A. Fabrikant and J. Rexford, "BGP Safety with Spurious Updates." In Proceedings of IEEE INFOCOM, April 2011.

21. W. Fisher, **M. Suchara** and J. Rexford, "Greening Backbone Networks: Reducing Energy Consumption by Shutting Off Cables in Bundled Links." In proceedings of the ACM SIGCOMM Workshop on Green Networking, August 2010.

22. U. Javed, **M. Suchara**, J. He and J. Rexford, "Multipath Protocol for Delay-Sensitive Traffic." Invited paper in COMSNETS, January 2009.

23. **M. Suchara**, L. Andrew, R. Witt, K. Jacobsson, B. Wydrowski and S. Low, "Implementation of Provably Stable MaxNet." In Proceedings of BROADNETS, September 2008.

24. J. He, **M. Suchara**, M. Bresler, J. Rexford and M. Chiang, "Rethinking Traffic Management: From Multiple Decompositions to a Practical Protocol." In Proceedings of CoNEXT, December 2007.

25. **M. Suchara**, I. Avramopoulos and J. Rexford, "Securing BGP Incrementally." In CoNEXT Student Workshop, December 2007.

26. **M. Suchara**, R. Witt and B. Wydrowski, "TCP MaxNet – An Implementation and Experiments on the WAN in Lab." In Proceedings of IEEE International Conference on Networks, March 2005.

27. M. Grocky, **M. Suchara**, Z. Kluiber, V. Janovec and Z. Zikmund, "Structure of Ferroelastic Domain Walls and Antiphase Boundaries in Crystals of β-K2SO4." XV-Czech-Polish seminar: "Structural and Ferroelectric Phase Transitions," May 2002.

Technical Reports and Preprints

28. W. Tang, T. Tomesh, J. Larson, **M. Suchara** and M. Martonosi. "CutQC: Using Small Quantum Computers for Large Quantum Circuit Evaluations." Available as ArXiv:2012.02333, 2020.

29. Z. Saleem, B. Tariq and **M. Suchara**, "Approaches to Constrained Quantum Approximate Optimization." Available as arXiv:2010.06660, 2020.

30. X. Wu, A. Kolar, J. Chung, D. Jin, T. Zhong, R. Kettimuthu and **M. Suchara**, "SeQUeNCe: A Customizable Discrete-Event Simulator of Quantum Networks." Available as arXiv:2009.12000, 2020.

31. T. Ayral, F-M. Le Régent, Z. Saleem, Y. Alexeev and **M. Suchara**, "Quantum Divide and Compute: Hardware Demonstrations and Noisy Simulations." Available as arXiv arXiv:2005.12874, 2020.

32. M. Perlin, Z. Saleem, **M. Suchara** and J. Osborn, "Quantum Circuits: Divide and Compute with Maximum Likelihood Tomography." Available as ArXiv:2005.12702, 2020.

33. K. Gui, T. Tomesh, P. Gokhale, Y. Shi, F. Chong, M. Martonosi and **M. Suchara**, "Term Grouping and Travelling Salesperson for Digital Quantum Simulation." Available as arXiv:2001.05983, 2020.

34. P. Gokhale, O. Angiuli, Y. Ding, K. Gui, T. Tomesh, **M. Suchara**, M. Martonosi and F. Chong, "Minimizing State Preparations in Variational Quantum Eigensolver by Partitioning into Commuting Families." Available as arXiv:1907.13623, 2019. **Winner of the IBM Q Best Paper Award.**

35. **M. Suchara**, A. Cross and J. Gambetta, "Leakage Suppression in the Toric Code." Available as arXiv 1410.8562, 2014.

36. S. Bravyi, **M. Suchara** and A. Vargo, "Efficient Algorithms for Maximum Likelihood Decoding in the Surface Code." Available as arXiv 1405.4883, 2014.

37. **M. Suchara**, A. Faruque, C. Lai, G. Paz, F. Chong and J. Kubiatowicz, "Comparing the Overhead of Topological and Concatenated Quantum Error Correction." Available as arXiv 1312.2316, 2013.

38. C-Y. Lai, G. Paz, **M. Suchara** and T. Brun, "Performance and Error Analysis of Knill's Postselection Scheme in a Two-Dimensional Architecture." Available as arXiv 1305.5657, 2013.

39. **M. Suchara**, A. Faruque, C. Lai, G. Paz, F. Chong and J. Kubiatowicz, "Estimating the Resources for Quantum Computation with the QuRE Toolbox." UC Berkeley Technical Report UCB/EECS-2013-119, May 2013.

40. S. Bravyi, G. Duclos-Cianci, D. Poulin and **M. Suchara**, "Subsystem surface codes with three-qubit check operators." Available as arXiv 1207.1443, 2012.

41. A. Abhari, A. Faruque, M. Dousti, L. Svec, O. Catu, A. Chakrabati, C-F. Chiang, S. Vanderwilt, J. Black, F. Chong, M. Martonosi, **M. Suchara**, K. Brown, M. Pedram and T. Brun, "Scaffold: Quantum Programming Language." Technical Report TR-934-12, Dept. of Computer Science, Princeton University, July 2012.

42. **M. Suchara**, S. Bravyi and B. Terhal, "Constructions and Noise Threshold of Topological Subsystem Codes." Available as arXiv 1012.0425, 2010.

43. **M. Suchara**, A. Fabrikant and J. Rexford, "BGP Safety with Spurious Updates." Technical Report TR-881-10, Dept. of Computer Science, Princeton University, July 2010.

44. I. Avramopoulos and M. Suchara, "Comparing the Security Performance of Network-Layer and Application-Layer Anycast." Technical Report TR-849-09, Dept. of Computer Science, Princeton University, March 2009.

45. I. Avramopoulos, **M. Suchara** and J. Rexford, "How Small Groups Can Secure Interdomain Routing." Technical Report TR-808-07, Dept. of Computer Science, Princeton University, December 2007.

PATENTS

- U.S. patent 10,728,769 – "Multi-Stage Object Detection and Categorization of Antenna Mount Locations," issued in July 2020
- U.S. patent 8,422,379 – "Method of Simple and Efficient Failure Resilient Load Balancing," issued in April 2013

SELECTED TALKS

50 conferences, workshops or meetings.

- **Quantum Network Simulations - Towards Reliable, Scalable, and Secure Quantum Network Architectures**
  Invited talks at the Optics and Quantum Electronics Seminar at MIT (3/2021), ISQNet Seminar at Northwestern (12/2020)

- **Quantum Information Science at Argonne National Laboratory**
  Birds-of-a-Feather session organizer and speaker, IEEE International Conference on Quantum Computing and Engineering – QCE20 (10/2020)

- **Q-NEXT: National Quantum Information Science Research Center**
  Speaker at the PSE Priorities All-Hands Meeting, Argonne (10/2020)

- **Running Large Quantum Circuits on Small Quantum Computers**
  Invited talk at the 2020 Quantum Computing User Forum, Oak Ridge National Laboratory (04/2020)

- **Quantum Simulations – Foundational Area**
  Speaker at the CQE Quantum Computing Workshop (01/2020)

- **Panel on Rejuvenating Post-Moore's Law Information Systems with Photonics**
  Invited panelist, PHOTONICS Workshop at SC19, Denver, CO (11/2019)

- **Simulation-Driven Design of Photonic Quantum Communication Networks**
  Contributed talk at PHOTONICS Workshop at SC19, Denver, CO (11/2019), LENS/CMP Seminar speaker at Indiana University (11/2019), CQE Quantum Networking Workshop speaker (10/2019)

- **SeQUeNCe - Simulator of Quantum Network Communication**
  Invited Talk, Quantum Computing User Forum, Oak Ridge, TN (04/2019)

- **Hybrid Quantum-Classical Computing Architectures**
  Argonne QIS Workshop, Lemont, IL (09/2019), Intel PCC Invited Talk (02/2019), The 3rd International Workshop on Post-Moore Era Supercomputing, Dallas, TX (11/2018)
- **Distributed Quantum Computing Architectures**
  APS March Meeting, Boston, MA (03/2019)
- **Introduction to Quantum Error Correction**
  Argonne Quantum Computing Tutorial, Lemont, IL (12/2018)
- **Introduction to Quantum Networking**
  Argonne Quantum Computing Tutorial, Lemont, IL (12/2018)
- **Efficient Fault-Tolerant Quantum Computing**
  Fishbowl Seminar at Texas A&M University (02/2017), QES Seminar, Princeton University (11/2016), IQC at the University of Waterloo (10/2016), CE Colloquium at TU Delft, Netherlands (09/2015)
- **Qubit Leakage Suppression in the Toric Code**
  APS March Meeting, San Antonio, TX (03/2015)
- **Baseline Resource Estimates for IARPA's Quantum Computer Science Program**
  IEEE ICCD, Asheville, NC (10/2013), Microsoft Research, Redmond, WA (08/2012), IARPA QCS PI Meeting, Princeton, NJ (07/2012), IARPA QCS Workshop, Minneapolis, MN (05/2012), IARPA QCS Technical Exchange Meeting, El Segundo, CA (01/2012)
- **Fast Parallel Decoder for Topological Error-Correcting Codes**
  IBM T. J. Watson Research Center (05/2012)
- **Constructions and Noise Threshold of Topological Subsystem Quantum Error-Correcting Codes**
  IQC at the University of Waterloo (02/2011), NEC Laboratories of America, Princeton, NJ (02/2011), UC Berkeley (12/2010), IQI at Caltech (12/2010), IBM T. J. Watson Research Center (08/2010)
- **BGP Safety with Spurious Updates: The Conditions of BGP Convergence**
  IEEE INFOCOM, Shanghai, China (04/2011), Harvard University (01/2011), Stanford University (01/2011), Yale University (10/2010), Columbia University (05/2010)
- **Simple Failure Resilient Load Balancing**
  ACM SIGMETRICS, San Jose, CA (06/2011), AT&T Labs Research, Florham Park, NJ (09/2008)
- **Greening Backbone Networks: Reducing Energy Consumption**
  ACM SIGCOMM Workshop on Green Networking, New Delhi, India (09/2010)
- **Rethinking Internet Traffic Management: From Multiple Decompositions to a Practical Protocol**
  Cambridge University (09/2008), Stanford University (04/2008), UC Berkeley (04/2008)
- **How Small Groups can Secure Interdomain Routing**
  Princeton University (01/2008), CoNEXT Student Workshop, New York, NY (12/2007)
- **TCP MaxNet: Implementation and Experiments on the WAN in Lab**
  BROADNETS 2008, London, UK (09/2008), IEEE ICON, Kuala Lumpur, Malaysia (11/2005), Stanford University (08/2005)

SOFTWARE RELEASES

- Simulator of Quantum Network Communication (SeQUeNCe): simulator created by a team led by Suchara suitable for simulation of quantum network prototypes that capture the breadth of current and future network technologies, protocols, and architectures. The tool is [available on GitHub](#) and consists of 7,957 lines of Python code and 750 commits.
- SeQUeNCe Go: an experimental high-performance implementation of the quantum network simulator in GoLang created to explore parallelism. Code is located in a GitLab repository and consists of 4,478 lines of code and 110 commits.

- Q-SPLIT: a suite of algorithms and software tools created by a team led by Suchara that split large quantum circuits into smaller subcircuits that solve an equivalent problem, consisting of 4,273 lines of Python code and 179 commits. Select tools were publicly [released on GitHub](#).

TEACHING ASSISTANTSHIPS

COS226 – Algorithms and Data Structures, Princeton	*Spring 2009*
COS424 – Interacting with Data – Machine Learning, Princeton	*Spring 2008*
COS126 – General Computer Science, Princeton	*Fall 2007*
CS21 – Decidability and Tractability, Caltech	*Winter 2005 and 2006*
CS38 – Introduction to Algorithms, Caltech	*Spring 2005*

TECHNICAL SKILLS

- Programming and scripting: C, C++, Python, Linux shell scripting
- Simulation and optimization: Matlab, Octave, AMPL, MOSEK
- Network protocol analysis and design: TCP, BGP, MPLS, etc.

REFERENCES

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