Tyler H. Chang

Argonne National Laboratory
Mathematics & Computer Science (MCS) Division
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Interests

Numerical optimization, machine learning, computational geometry, analysis of algorithms, and scientific software

Education

Ph.D., May 2020, Computer Science, Virginia Polytechnic Institute & State University (Virginia Tech)
- *Advisor: Layne Watson*
- *Dissertation: Mathematical Software for Multiobjective Optimization Problems*

B.S., May 2016, Computer Science & Mathematics (double-major), Virginia Wesleyan University
- *Summa cum laude; 2x ACM ICPC site champion; 8x Dean's list; 4x all-ODAC (conference) for varsity tennis*

Recent Research Experience

Jun 2020 - Present. **Postdoctoral appointee: Argonne National Laboratory**, MCS Division
- Designed and implemented a Python framework for building and deploying multiobjective optimization solvers
- Deployed optimization solvers for particle accelerator design, material discovery, and DFT modeling

Aug 2016 - May 2020. **Cunningham fellow: Virginia Tech**, Dept. of Computer Science
- Designed parallel algorithms and software for predicive modeling, blackbox optimization, and computational geometry
- Applied solvers to model and tune HPC systems to control performance variability

Jun 2019 - Dec 2019. **SCGSR awardee: Argonne National Laboratory**, MCS Division
- Conducting research in multiobjective optimization software via DOE SCGSR program (see awards)

Feb 2016 - Aug 2016. **Research assistant: Old Dominion University**, Dept. of Computer Science
- Aided in parallelizing NASA's FUN3D CFD kernel on NVIDIA GPUs using CUDA and MPI

Awards

2021. **Nominee for Outstanding Dissertation Award: Virginia Tech**, Graduate School
2019. **Davenport Leadership Fellowship: Virginia Tech**, College of Engineering
2018. **SCGSR Award: DOE Office of Science**, Graduate Student Research (SCGSR) Program
2018. **Pratt Fellowship: Virginia Tech**, College of Engineering
2017. **Pratt Fellowship: Virginia Tech**, College of Engineering
2016. **Cunningham Doctoral Fellowship: Virginia Tech**, Graduate School
2016. **Davenport Leadership Fellowship: Virginia Tech**, College of Engineering
2016. **Outstanding Student in Computer Science & Mathematics: Virginia Wesleyan University**

Selected Publications (from 25 total)

2023. **T. H. Chang**, J. R. Elias, S. M. Wild, S. Chaudhuri, and J. A. Libera. A framework for fully autonomous design of materials via multiobjective optimization and active learning: challenges and next steps. *To appear in 11th Intl. Conf. on Learning Representation (ICLR 2023), Workshop on Machine Learning for Materials (ML4Materials)*. Kigali, Rwanda.

2023. **T. H. Chang** and S. M. Wild. ParMOO: a Python library for parallel multiobjective simulation optimization. *Journal of Open Source Software* 8(82), Article 4468, 5 pages.

2022. **T. H. Chang**, L. T. Watson, J. Larson, N. Neveu, W. I. Thacker, S. Deshpande, and T. C. H. Lux. Algorithm 1028: VTMOP: Solver for blackbox multiobjective optimization problems. *ACM Transactions on Mathematical Software* 48(3), Article 36, 34 pages.

2020. **T. H. Chang**, J. Larson, and L. T. Watson. Multiobjective optimization of the variability of the high-performance Linpack solver. *Proc. 2020 Winter Simulation Conference (WSC 2020)*, pp. 3081–3092. virtual event.

2020. **T. H. Chang**, L. T. Watson, T. C. H. Lux, A. R. Butt, K. W. Cameron, and Y. Hong. Algorithm 1012: DELAUNAYSPARSE: Interpolation via a sparse subset of the Delaunay triangulation in medium to high dimensions. *ACM Transactions on Mathematical Software* 46(4), Article 38, 20 pages.

Publicly Available Software

2023. **ParMOO**: Python library for parallel multiobjective simulation optimization. Release: 0.2.1
Devs: **T. H. Chang** (lead), S. M. Wild, and H. Dickinson[1] Primary Prog. Lang: `Python 3`
`git: https://github.com/parmoo/parmoo`

2022. **VTMOP**: Solver for blackbox multiobjective optimization problems.
Devs: **T. H. Chang** (sole) Primary Prog. Lang: `Fortran 2008`
`git: https://github.com/vtopt/VTMOP`

2020. **DelaunaySparse**: Interpolation via a sparse subset of the Delaunay triangulation.
Devs: **T. H. Chang** (lead) and T. C. H. Lux Primary Prog. Lang: `Fortran 2003`
`git: https://github.com/vtopt/DelaunaySparse`

2019. **QAML**: Quantum annealing math library.
Devs: T. C. H. Lux (lead), **T. H. Chang**, and S. S. Tipirneni Primary Prog. Lang: `Python 3`
`git: https://github.com/tchlux/qaml`

Current Funding

Mar 2023 - Sep 2023. A Scalable Multi-Physics Optimization Framework for Particle Accelerator Design.
ANL LDRD: 2023 LDRD Seed (LDRD 2023-0246).
Type: ANL LDRD seed award. Budget: $50K.
Role: co-PI. PI: G. Chen (ANL).

Teaching

Jan 2022 - Present. **Adjunct Professor: College of DuPage**, Dept. of Computer and Info. Science
- Spring 2022. CIS 2531: Introduction to Python Programming (online)

Jan 2020 - May 2020. **Instructor of Record: Virginia Tech**, Dept. of Computer Science
- Spring 2020. CS 3114: Data Structures and Algorithms (half in-person, half online)

[1]= DOE SULI at Argonne in my supervision

Summer Students Advised

Jun 2022 - Aug 2022.	Hyrum Dickinson (Urbana-Champaign), DOE SULI at Argonne
Jun 2022 - Aug 2022.	Manisha Garg (Urbana-Champaign), NSF MSGI at Argonne

Professional Services and Activities

Journal Referee

- ACM Transactions on Mathematical Software (2021–Present)
- The Visual Computer Journal (2021)
- Quantum Information Processing (2021)
- MDPI: Mathematical and Computer Applications (2021)
- Journal of Machine Learning Research (2019)

Conference Reviewer

- Int. Conf. for HPC, Networking, Storage, and Analysis (Supercomputing) 2021
- IEEE SoutheastCon 2020
- IEEE SoutheastCon 2019
- IEEE SoutheastCon 2018

Minisymposium Organizer

- SIAM Conference on Optimization (2021)
- SIAM Conference on Computational Science and Engineering (2021)

Professional Membership

- ACM (2015–Present)
- SIAM (2016–Present)
- MOS (2022–Present)