# Tyler H. Chang

Argonne National Laboratory
Mathematics & Computer Science (MCS) Division
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## Technical Skills

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| **Languages:** | Python, Fortran, C/C++, Java, Matlab |
| **OS:** | MacOS, Unix/Linux |
| **Markup:** | HTML/CSS, GNU Make, TeX/LaTeX/bibTeX |
| **Libraries:** | numpy, pandas, scipy, matplotlib, keras, sklearn, MPI, OpenMP, CUDA, BLAS, LAPACK |
| **Tools/Frameworks:** | pytest, sphinx, slurm, CI/CD, GitHub Actions, GitFlow |

## Relevant 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

Dec 2015 - Jan 2016. **Intern: US Army Research Labs**, Computational Science Division
May 2015 - Aug 2015. **Intern: US Army Research Labs**, Computational Science Division
- Accelerating software for real-time optimal control (summer) & using AR technology for info viz (winter)

Dec 2014 - Jan 2015. **Intern: US Army Research Labs**, Guidance Technology Branch
May 2014 - Aug 2014. **Intern: US Army Research Labs**, Guidance Technology Branch
- Using OpenCV for real-time sensing (summer) & developing software for embedded systems (winter)

## 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*

## Relevant Projects

Oct 2021 - Present. **Self-Driving Labs, automating material discovery via continuous-flow chemistry**

- Discovered ideal mixtures/settings to produce the battery electrolyte 2,2,2-TFMC in a continuous-flow reactor (CFR)
- Used a Bayesian/active learning framework to steer an automated feed, CFR, and NMR in a user-free feedback loop

Sep 2016 - May 2020. **The VarSys Project, NSF-funded study of performance variability in HPC systems**

- Member of the math and algorithms team on an interdisciplinary project to model and control performance variability
- Tuned the Linpack solver on the leadership-class HPC Bebop, resulting in a 3x reduction in performance variability

## 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: 0.2.2
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`

## Leadership Activities

### Students Advised

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

[1] = DOE SULI at Argonne in my supervision