Tyler H. Chang

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Website: **https://thchang.github.io**
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Technical Skills

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
- Supervisor: Stefan Wild
- Designed and implemented a Python framework for building and deploying multiobjective optimization solvers
- Deployed solvers for particle accelerator design, autonomous material discovery, and neural-network architecture search
- Applied for grants, supervised interns, authored scientific papers, and represented Argonne at international conferences

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
- Published papers in academic journals and conferences

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)

6. 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. *11th Intl. Conf. on Learning Representation (ICLR 2023), Workshop on Machine Learning for Materials (ML4Materials)*. Kigali, Rwanda.

5. 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.

4. 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.

3. 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. Orlando, FL, USA.

2. 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.

1. 2019. **T. H. Chang**, T. C. H. Lux, and S. S. Tipirneni. Least-squares solutions to polynomial systems of equations with quantum annealing. *Quantum Information Processing* 18(12), Article 374, 17 pages.

Publicly Available Software

4. 2023.   ParMOO: Python library for parallel multiobjective simulation optimization. Release: 0.3.0
Devs: **T. H. Chang** (lead), S. M. Wild, and H. Dickinson[1]   Primary Prog. Lang: `Python 3`
git: `https://github.com/parmoo/parmoo`

3. 2022.   VTMOP: Solver for blackbox multiobjective optimization problems.
Devs: **T. H. Chang** (sole)   Primary Prog. Lang: `Fortran 2008`
git: `https://github.com/vtopt/VTMOP`

2. 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`

1. 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`

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[1] = DOE SULI at Argonne in my supervision

Leadership Activities

Students Advised

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

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