Tyler H. Chang

Argonne National Laboratory
Mathematics & Computer Science (MCS) Division
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Website: `https://thchang.github.io`
GitHub: `https://github.com/thchang`

Technical Skills

Languages:	Python, Fortran, C/C++, Java, Matlab
OS:	MacOS, Unix/Linux
Markup:	HTML/CSS, GNU Make, TeX/LaTeX/bibTeX, Markdown, reStructuredText, YAML, JSON
Libraries:	numpy, pandas, scipy, matplotlib, keras, pytorch, sklearn, PIL, OpenCV, MPI, OpenMP, CUDA, BLAS, LAPACK
Tools/Frameworks:	pytest, sphinx, PyPI/pip, conda-forge, slurm, git, 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, chemical design (see projects), and computational physics

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 (see projects) 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)
- *Thesis: Math. Softw. for Multiobjective Optimization Problems; Outstanding Dissertation Award nominee*

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**

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

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

- An interdisciplinary project, I was a member of our math and algorithms team working to model and control variability
- I successfully tuned the leadership-class HPC Bebop, resulting in a 3x variance reduction in the Linpack benchmark

Selected Publications (from over 24 total)

T. H. Chang and S. M. Wild. ParMOO: a Python library for parallel multiobjective simulation optimization. *Submitted to Journal of Open Source Software*, May 2022. JOSS Open Review: `https://github.com/openjournals/joss-reviews/issues/4468`.

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.

2018. **T. H. Chang**, L. T. Watson, T. C. H. Lux, B. Li, L. Xu, A. R. Butt, K. W. Cameron, and Y. Hong. A polynomial time algorithm for multivariate interpolation in arbitrary dimension via the Delaunay triangulation. *Proc. 2018 ACM Southeast Conference (ACMSE '18)*, Article 12, 8 pages. Richmond, KY, USA.

Publicly Available Software

2022. **ParMOO**: Python library for parallel multiobjective simulation optimization. Release: 0.1.0
Devs: **T. H. Chang** (lead), S. M. Wild, and H. Dickinson 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

Jun 2022 - Aug 2022.	Manisha Garg (PhD student at UIUC), intern at Argonne via NSF MSGI program
Jun 2022 - Aug 2022.	Hyrum Dickinson (undergrad at UIUC), intern at Argonne via DOE SULI program