# Tyler H. Chang – CV

## Computational Researcher, Senior Software Engineer

Mountain View, CA, USA



#### INTERESTS

Numerical optimization, scientific machine learning, high-performance and parallel computing, and open source software



# **EXPERIENCE**

Jun 2024 - Present. Senior Software Engineer: Siemens Digital Industry Software, EDA / HAV Division

Jun 2020 - May 2024. Postdoctoral appointee: Argonne National Laboratory, MCS Division

Aug 2016 - May 2020. Research fellow: Virginia Tech, Dept. of Computer Science

Feb 2016 - Aug 2016. Research assistant: Old Dominion University, Dept. of Computer Science



#### **EDUCATION**

Ph.D., May 2020, Computer Science, Virginia Polytechnic Institute & State University (Virginia Tech)

B.S., May 2016, Computer Science & Mathematics (double-major), Virginia Wesleyan University, summa cum laude

# Publicly Available Software

4. 2022 (latest release 2024). ParMOO: Python library for parallel multiobjective simulation optimization. Release: 0.4.1

Devs: **T. H. Chang** (lead), S. M. Wild, and H. Dickinson<sup>1</sup> Primary Prog. Lang: Python 3

git: https://github.com/parmoo/parmoo

3. 2020 (latest release 2024). DelaunaySparse: Interpolation via a sparse subset of the Delaunay triangulation.

Devs: T. H. Chang (lead), T. C. H. Lux, and L. T. Watson Primary Prog. Lang: Fortran 2003

git: https://github.com/vtopt/DelaunaySparse

2. 2022. VTMOP: Solver for blackbox multiobjective optimization problems.

Primary Prog. Lang: Fortran 2008 Devs: T. H. Chang (lead) and L. T. Watson

git: https://github.com/vtopt/VTMOP

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



#### **PUBLICATIONS**

#### Peer-Reviewed Journal Articles

- 13. 2025. T. H. Chang and S. M. Wild. Designing a framework for solving multiobjective simulation optimization problems. To appear in INFORMS Journal on Computing, 33 pages. doi: 10.1287/ijoc.2023.0250
- 12. 2025. T. H. Chang, A. K. Gillette, and R. Maulik. Leveraging interpolation models and error bounds for verifiable scientific machine learning. Journal of Computational Physics 524, Article 113726, 23 pages. doi: 10.1016/j.jcp.2025.113726
- 11. 2024. T. H. Chang, L. T. Watson, S. Leyffer, T. C. H. Lux, and H. M. J. Almohri. Remark on Algorithm 1012: computing projections with large data sets. ACM Transactions on Mathematical Software 50(2), Article 12, 8 pages. doi: 10.1145/3656581
- 10. 2023. T. C. H. Lux, L. T. Watson, T. H. Chang, and W. I. Thacker. Algorithm 1031: MQSI—Monotone quintic spline interpolation. ACM Transactions on Mathematical Software 49(1), Article 6, 17 pages. doi: 10.1145/3570157
- 9. 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. doi: 10.21105/joss.04468

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<sup>&</sup>lt;sup>1</sup>= DOE SULI (undergraduate intern) at Argonne in my supervision

- 8. 2023. N. Neveu, **T. H. Chang**, P. Franz, S. Hudson, and J. Larson. Comparison of multiobjective optimization methods for the LCLS-II photoinjector. *Computer Physics Communication* 283, Article 108566, 10 pages. **doi:** 10.1016/j.cpc.2022.108566
- 7. 2023. Y. Wang, L. Xu, Y. Hong, R. Pan, **T. H. Chang**, T. C. H. Lux, J. Bernard, L. T. Watson, and K. W. Cameron. Design strategies and approximation methods for high-performance computing variability management. *Journal of Quality Technology* 55(1), pp. 88–103. doi: 10.1080/00224065.2022.2035285
- 6. 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. doi: 10.1145/3529258
- 5. 2021. L. Xu, T. C. H. Lux, **T. H. Chang**, B. Li, Y. Hong, L. T. Watson, A. R. Butt, D. Yao, and K. W. Cameron. Prediction of high-performance computing input/output variability and its application to optimization for system configurations. *Quality Engineering* 33(2), pp. 318–334. **doi:** 10.1080/08982112.2020.1866203
- 4. 2021. T. C. H. Lux, L. T. Watson, **T. H. Chang**, J. Bernard, B. Li, L. Xu, G. Back, A. R. Butt, K. W. Cameron, and Y. Hong. Interpolation of sparse high-dimensional data. *Numerical Algorithms* 88(1), pp. 281–313. doi: 10.1007/s11075-020-01040-2
- 3. 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. **doi:** 10.1145/3422818
- 2. 2020. L. Xu, Y. Wang, T. C. H. Lux, **T. H. Chang**, J. Bernard, B. Li, Y. Hong, K. W. Cameron, and L. T. Watson. Modeling I/O performance variability in high-performance computing systems using mixture distributions. *Journal of Parallel and Distributed Computing* 139, pp. 87–98. **doi:** 10.1016/j.jpdc.2020.01.005
- 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. **doi:** 10.1007/s11128-019-2489-x

## Peer-Reviewed Conference and Workshop Papers

- 15. 2023. G. Chen, **T. H. Chang**, J. Power, and C. Jing. An integrated multi-physics optimization framework for particle accelerator design. *In Proc. 2023 Winter Simulation Conference (WSC 2023), Industrial Applications Track*, 2 pages. Orlando, FL, USA. **doi:** 10.48550/arXiv.2311.09415
- 14. 2023. M. Garg<sup>2</sup>, **T. H. Chang**, and K. Raghavan. SF-SFD: Stochastic optimization of Fourier coefficients for space-filling designs. *In Proc.* 2023 Winter Simulation Conference (WSC 2023), pp. 3636–3646. Orlando, FL, USA. doi: 10.1109/WSC60868.2023.10408245
- 13. 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. *In 11th Intl. Conf. on Learning Representation (ICLR 2023), Workshop on Machine Learning for Materials (ML4Materials*). Kigali, Rwanda. **url:** https://openreview.net/forum?id=8KJS7RPjMqG
- 12. 2020. **T. H. Chang**, J. Larson, and L. T. Watson. Multiobjective optimization of the variability of the high-performance Linpack solver. *In Proc. 2020 Winter Simulation Conference (WSC 2020)*, pp. 3081–3092. Orlando, FL, USA. **doi:** 10.1109/WSC48552.2020.9383875
- 11. 2020. **T. H. Chang**, J. Larson, L. T. Watson, and T. C. H. Lux. Managing computationally expensive blackbox multiobjective optimization problems with libEnsemble. *In Proc. 2020 Spring Simulation Conference (SpringSim '20)*, Article 31, 12 pages. Fairfax, VA, USA. **doi:** 10.22360/springsim.2020.hpc.001
- 10. 2020. T. C. H. Lux, L. T. Watson, **T. H. Chang**, L. Xu, Y. Wang, and Y. Hong. An algorithm for constructing monotone quintic interpolating splines. *In Proc. 2020 Spring Simulation Conference (SpringSim '20)*, Article 33, 12 pages. Fairfax, VA, USA. **doi:** 10.22360/springsim.2020.hpc.003
- 9. 2020. T. C. H. Lux and **T. H. Chang**. Analytic test functions for generalizable evaluation of convex optimization techniques. *In Proc. IEEE SoutheastCon 2020*, 8 pages. Raleigh, NC, USA. **doi:** 10.1109/SoutheastCon44009.2020.9368254
- 8. 2020. T. C. H. Lux, L. T. Watson, **T. H. Chang**, L. Xu, Y. Wang, J. Bernard, Y. Hong, and K. W. Cameron. Effective nonparametric distribution modeling for distribution approximation applications. *In Proc. IEEE SoutheastCon 2020*, 6 pages. Raleigh, NC, USA. doi: 10.1109/SoutheastCon44009.2020.9368295
- 7. 2018. **T. H. Chang**, L. T. Watson, T. C. H. Lux, S. Raghvendra, B. Li, L. Xu, A. R. Butt, K. W. Cameron, and Y. Hong. Computing the umbrella neighbourhood of a vertex in the Delaunay triangulation and a single Voronoi cell in arbitrary dimension. *In Proc. IEEE SoutheastCon 2018*, 8 pages. St. Petersburg, FL, USA. **doi:** 10.1109/SECON.2018.8479003
- 6. 2018. T. C. H. Lux, L. T. Watson, **T. H. Chang**, J. Bernard, B. Li, X. Yu, L. Xu, G. Back, A. R. Butt, K. W. Cameron, Y. Hong, and D. Yao. Nonparametric distribution models for predicting and managing computational performance variability. *In Proc. IEEE SoutheastCon 2018*, 7 pages. St. Petersburg, FL, USA. **doi:** 10.1109/SECON.2018.8478814

<sup>&</sup>lt;sup>2</sup>= NSF MSGI (PhD student intern) at Argonne in my supervision

- 5. 2018. **T. H. Chang**, L. T. Watson, T. C. H. Lux, J. Bernard, B. Li, L. Xu, G. Back, A. R. Butt, K. W. Cameron, and Y. Hong. Predicting system performance by interpolation using a high-dimensional Delaunay triangulation. *In Proc. 2018 Spring Simulation Conference (SpringSim '18)*, Article 2, 12 pages. Baltimore, MD, USA. **doi:** 10.22360/springsim.2018.hpc.003
- 4. 2018. T. C. H. Lux, L. T. Watson, **T. H. Chang**, J. Bernard, B. Li, L. Xu, G. Back, A. R. Butt, K. W. Cameron, and Y. Hong. Predictive modeling of I/O characteristics in high performance computing systems. *In Proc. 2018 Spring Simulation Conference (SpringSim '18)*, Article 8, 10 pages. Baltimore, MD, USA. **doi:** 10.22360/springsim.2018.hpc.009
- 3. 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. *In Proc. 2018 ACM Southeast Conference (ACMSE '18)*, Article 12, 8 pages. Richmond, KY, USA. **doi:** 10.1145/3190645.3190680
- 2. 2018. T. C. H. Lux, L. T. Watson, **T. H. Chang**, J. Bernard, B. Li, X. Yu, L. Xu, G. Back, A. R. Butt, K. W. Cameron, D. Yao, and Y. Hong. Novel meshes for multivariate interpolation and approximation. *In Proc. 2018 ACM Southeast Conference (ACMSE '18)*, Article 13, 7 pages. Richmond, KY, USA. **doi:** 10.1145/3190645.3190687
- 1. 2017. C. Raghunath, **T. H. Chang**, L. T. Watson, M. Jrad, R. K. Kapania, and R. M. Kolonay. Global deterministic and stochastic optimization in a service oriented architecture. *In Proc. 2017 Spring Simulation Conference (SpringSim '17)*, Article 7, 12 pages. Virginia Beach, VA, USA. **doi:** 10.22360/springsim.2017.hpc.023



## TALKS AND PRESENTATIONS

#### **Invited Conference Talks**

- 6. Aug 2023. Data sampling for surrogate modeling and optimization. *The 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023)*, Tokyo, Japan.
- 5. Jun 2023. Exploiting structures in multiobjective simulation optimization problems. *SIAM Conference on Optimization (OP 2023)*, Seattle, WA, USA.
- 4. Mar 2023. ParMOO: a Python library for parallel multiobjective simulation optimization. *SIAM Conference on Computational Science and Engineering (CSE 2023)*, Amsterdam, Netherlands.
- 3. Sep 2022. Geometric considerations when surrogate modeling. SIAM Conference on Mathematics of Data Science (MDS 2022), San Diego, CA, USA.
- 2. Jul 2021. Surrogate modeling of simulations for multiobjective optimization applications. *SIAM Conference on Optimization* (*OP 2021*), virtual event.
- 1. Mar 2021. Computing sparse subsets of the Delaunay triangulation in high-dimensions for interpolation and graph problems. SIAM Conference on Computational Science and Engineering (CSE 2021), virtual event.

## Seminars and Colloquia

- 5. Sep 2023. The curse of dimensionality. CAA&CM Argonne Student Visit, Lemont, IL, USA.
- 4. July 2023. Toward interpretable machine learning via Delaunay interpolation challenges and next steps. *Argonne National Laboratory, LANS Seminar Series*, Lemont, IL, USA.
- 3. Feb 2020. Algorithms and software for Delaunay interpolation and multiobjective optimization. *Sandia National Laboratory, Wind Energy Technology Division Seminar*, virtual event.
- 2. Feb 2020. Algorithms and software for Delaunay interpolation and multiobjective optimization. *Argonne National Laboratory, Mathematics and Computer Science Division Seminar*, Lemont, IL, USA.
- 1. Jan 2020. Algorithms and software for Delaunay interpolation and multiobjective optimization. *Sandia National Laboratory, Center for Computing Research Seminar*, Albuquerque, NM, USA.

## **Tutorials and Guest Lectures**

- 2. Oct 2022. An introduction to multiobjective simulation optimization with ParMOO. *The Science Academy, Science Circle Cohort, guest speaker*, virtual event. Recording: https://www.youtube.com/watch?v=gqha8urlehm.
- 1. May 2022. An introduction to multiobjective simulation optimization with ParMOO. *University of Chicago, Pritzker School of Molecular Engineering, guest lecture*, virtual event.



## Research Funding Raised

- 3. Declined for FY 2024. **Key contributor** (Industry collaborator: GE Vernova, Institutional Lead: S. Chaudhuri (UIC/ANL)), \$400K/y for 1 year. *High performance computing for development of critical thermodynamic inputs for next generation thermal barrier coatings*, external grant (7 pages + appendices). DOE: HPC4EnergyInnovation Program: Summer 2024 Collaborations for U.S. Manufacturers.
- 2. Mar 2023 Sep 2023. **Co-PI** (PI: G. Chen (ANL)), \$50K/y for 1 year (my share: \$25K). *A Scalable Multi-Physics Optimization Framework for Particle Accelerator Design*, institutional seed funding (3 pages + appendices). ANL LDRD: 2023 LDRD Seed (LDRD 2023-0246).
- 1. Jun 2019 Dec 2019. **Primary awardee** (Advisors: J. Larson (ANL) and L. Watson (VT)), \$3K/mo for 6 months. *An Adaptive Weighting Scheme for Multiobjective Optimization*, DOE award for PhD students (3 pages + appendices). DOE SCGSR/ASCR: SCGSR Program 2018 Solicitation 2 (DE-SC0014664).

## Research Fellowships

- 5. Aug 2016 May 2020. Cunningham Doctoral Fellowship, Virginia Tech, Graduate School, guaranteed research funding
- 4. Aug 2019 May 2020. Davenport Leadership Fellowship, Virginia Tech, College of Engineering, \$4k supplemental award
- 3. Aug 2018 May 2019. Pratt Fellowship, Virginia Tech, College of Engineering, \$4k supplemental award
- 2. Aug 2017 May 2018. Pratt Fellowship, Virginia Tech, College of Engineering, \$4k supplemental award
- 1. Aug 2016 May 2017. Davenport Leadership Fellowship, Virginia Tech, College of Engineering, \$4k supplemental award

#### Other Awards

- 4. Jan 2021. Nominee for Outstanding Dissertation Award, Virginia Tech, Graduate School
- 3. Apr 2016. Outstanding Student in Computer Science & Mathematics, Virginia Wesleyan University
- 2. Feb 2016. ACM International Collegiate Programming Competition (ICPC), winning team for CNU site, VA, USA
- 1. Feb 2015. ACM International Collegiate Programming Competition (ICPC), winning team for CNU site, VA, USA



## LEADERSHIP AND OTHER PROFESSIONAL ACTIVITIES

#### Teaching Experience

Jan 2022 - Feb 2024.	Adjunct Professor: College of DuPage, Dept. of Computer and Info. Science (Intro to Python)
Jan 2020 - May 2020.	Instructor of Record: Virginia Tech, Dept. of Computer Science (Data structures and algorithms)
Jan 2013 - Dec 2015.	Subject Tutor: Virginia Wesleyan University (Calculus, computer science, and statistics)

#### Interns Advised

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

#### Journal Referee

Optimization Methods and Software; Journal of Supercomputing (2024–Present); INFORMS Journal on Computing (2023–Present); ACM Transactions on Mathematical Software (2021–Present); Quantum Information Processing (2021–Present); The Visual Computer Journal (2021); MDPI: Mathematical and Computer Applications (2021); Journal of Machine Learning Research (2019)

## Conference Reviewer

ICIAM (2023); Supercomputing (2021); IEEE SoutheastCon (2018–2020)

# Minisymposium Organizer

Multiobjective Optimization Software track in SIAM Conference on Optimization (2021); Geometric Methods for Machine Learning track in SIAM Conference on Computational Science and Engineering (2021)

# **Professional Membership**

ACM (2015-Present); SIAM (2016-Present)