Hoang A. Tran

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Education

2008 – 2013 Ph.D., Mathematics, University of Pittsburgh, PA, USA.
Thesis advisors: Profs. Catalin Trenchea and William Layton.

2007 – 2008 M.S., Applied Mathematics, Université d'Orléans, Orléans, France.

2002 – 2006 B.S., Mathematics, Honor Program, University of Science, Ho Chi Minh City, Vietnam.

Professional Experiences

2016 – now Staff Mathematician, Computer Science and Mathematics Division, Oak Ridge National Laboratory.

2013 – 2016 Postdoctoral Research Associate, Computer Science and Mathematics Division, Oak Ridge National Laboratory. Mentor: Clayton Webster.

2008 – 2013 Teaching/Research Assistant, Department of Mathematics, University of Pittsburgh.

2006 – 2008 Instructor, Department of Mathematics, University of Science, Vietnam.

Research Interests

- Compressed Sensing
- Machine Learning
- High-dimensional Approximation Theory
- Numerical Solution of Partial Differential Equations
- Turbulence Modeling, Coupling Free Flow and Porous Media Flow

Publications

Journal papers

26. Hoang Tran, Clayton Webster. Analysis of sparse recovery for Legendre expansions using envelope bound, submitted, 2019. https://arxiv.org/abs/1810.02926.

25. Nick Dexter, Hoang Tran, Clayton Webster. On the Strong Convergence of Forward-Backward Splitting in Reconstructing Jointly Sparse Signals, submitted, 2019. https://arxiv.org/abs/1711.02591v2.

24. Joseph Daws, Armenak Petrosyan, Hoang Tran, Clayton Webster. A weighted l_1 minimization approach for wavelet reconstruction of signals and images, submitted, 2019. https://arxiv.org/abs/1909.07270.

23. Yiming Xu, Akil Narayan, Hoang Tran, Clayton Webster. Analysis of the ratio of l_1 and l_2 norms in compressed sensing, submitted, 2020. https://arxiv.org/abs/2004.05873

22. Nick Dexter, Hoang Tran, Clayton Webster. A mixed l_1 regularization approach for sparse simultaneous approximation of parameterized PDEs, *ESAIM: Mathematical Modelling and Numerical Analysis*, 53(6), pp. 2025-2045, 2019.

21. Armenak Petrosyan, Hoang Tran, Clayton Webster. Reconstruction of jointly sparse vectors via manifold optimization, *Applied Numerical Mathematics* 144, pp. 140-150, 2019.

20. Anh Tran, Hoang Tran. Data-driven high-fidelity 2D microstructure reconstruction via non-local patch-based image inpainting, *Acta Materialia* 178, pp. 207-218, 2019.

19. Anh Tran, Dehao Liu, Hoang Tran, Yan Wang. Quantifying uncertainty in the process-structure relationship for Al-Cu solidification, *Modelling and Simulation in Material Science and Engineering* 27 (2019) 064005.

18. Hoang Tran, Clayton Webster. A class of null space conditions for sparse recovery via nonconvex, non-separable minimizations, *Results in Applied Mathematics* 3 (2019) 100011.

17. Abdellah Chkifa, Nick Dexter, Hoang Tran, Clayton Webster. Polynomial Approximation via Compressed Sensing of High-dimensional Functions on Lower Sets, *Math. Comp.*, 87 (2018), pp. 1415-1450.

16. Michaela Kubacki, Hoang Tran. Non-iterative Partitioned Methods for Uncoupling Evolutionary Groundwater-Surface Water Flows, *Fluids* 2017, 3, 47; doi:10.3390/fluids2030047.

15. Hoang Tran, Clayton Webster, Guannan Zhang. Analysis of Quasi-Optimal Polynomial Approximations for Parameterized PDEs with Deterministic and Stochastic Coefficients, *Numer. Math.* (2017), 137:451-493.

14. Martina Bukac, William Layton, Catalin Trenchea, Marina Moraiti, Hoang Tran. Analysis of Partitioned Methods for Biot System, *Numer. Methods Partial Differential Equations*, 31: 1769–1813, 2015.

13. Nan Jiang, Hoang Tran. Analysis of A Stabilized CNLF Method with Fast Slow Wave Splittings for Flow Problems, *Comput. Methods Appl. Math.*, 15(3), pp. 307–330, 2015.

12. Nan Jiang, Michaela Kubacki, William Layton, Marina Moraiti and Hoang Tran. Unconditional Stability of a Crank-Nicolson Leap-Frog Stabilization and Applications, *J. Comput. Appl. Math.*, 281 (2015), 263-276.

11. William Layton, Hoang Tran, Catalin Trenchea. Numerical Analysis of Two Partitioned Methods for Uncoupling Evolutionary MHD Flows, *Numer. Methods Partial Differential Equations*, 30(4), 1083-1102, 2014.

10. William Layton, Hoang Tran, Catalin Trenchea. Analysis of Long Time Stability and Errors of Two Partitioned Methods for Uncoupling Evolutionary Groundwater - Surface Water Flows, *SIAM J. Numer. Anal.*, 51(1), 248-272, 2013.

9. William Layton, Hoang Tran, Xin Xiong. Long Time Stability of Four Methods for Splitting the Evolutionary Stokes-Darcy Problem into Stokes and Darcy Sub-problems, *J. Comput. Appl. Math.*, 236 (13) (2012), 3198-3217.

8. William Layton, Lars Roehe, Hoang Tran. Explicitly Uncoupled Variational Multiscale Stabilization of Fluid Flow, *Comput. Methods Appl. Mech. Engrg.* 200 (2011), No. 45-46, pp. 3183-3199.

Conference Papers

7. Jiaxin Zhang, Hoang Tran, Guannan Zhang. Accelerating reinforcement learning with a directional Gaussian smoothing evolution strategy, submitted, 2020. https://arxiv.org/abs/2002.09077

6. Jiaxin Zhang, Hoang Tran, Dan Lu, Guannan Zhang. A scalable evolution strategy with directional Gaussian smoothing for blackbox optimization, submitted, 2020. https://arxiv.org/abs/2002.03001

5. Nick Dexter, Hoang Tran, Clayton Webster. Reconstructing high-dimensional Hilbert-valued functions via compressed sensing, *13th International Conference on Sampling Theory and Applications (SampTA 2019)*.

4. William Layton, Hoang Tran, and Catalin Trenchea. Stability of partitioned methods for magnetohydrodynamics flows at small magnetic Reynolds number, *Contemp. Math.*, vol. 586, pp. 231-238, 2013.

3. Timothy Luciani, Adrian Maries, Hoang Tran, Mehdi Nik, Levent Yilmaz, Elisabeta Marai. A Novel Method for Tracking Tensor-based Regions of Interest in Large-Scale, Spatially-Dense Turbulent Combustion Data, *IEEE VisWeek 2012, Poster Abstracts with System Demonstration*, pp. 1-2, 2012.

Book Chapters

2. Hoang Tran, Clayton Webster, Guannan Zhang. A Sparse-Grid Method for Bayesian Uncertainty Quantification with Application to Large Eddy Simulation Turbulence Models, In: Garcke J., Pflüger D. (eds) *Sparse Grids and Applications - Stuttgart 2014. Springer Lecture Notes in Computational Science and Engineering*, vol 109, pp. 291-313, 2016.

Technical Reports

1. Hoang Tran, Catalin Trenchea, Clayton Webster. A Convergence Analysis of Stochastic Collocation Method for Navier-Stokes Equations with Random Input Data, *ORNL Technical Report*, Oak Ridge National Laboratory, 2014.

Grants and Contracts

Current funding support

2017 – 2020 DOE SciDAC – Advanced Scientific Computing Research
Frameworks, Algorithms and Scalable Technologies for Mathematics (FASTMath)
Role: Senior Investigator.

2019 – 2021 ORNL – Laboratory Directed Research and Development
Secure biosystems design of plants and microbiomes
Role: Senior Investigator.

2019 – 2020 ORNL – Laboratory Directed Research and Development
ORNL Artificial Intelligence Initiative
Role: Senior Investigator.

Previous funding support

2015 – 2017 Department of Defense – Defense Advanced Research Projects Agency
Foundations of Rigorous Mathematics for Uncertainty Quantification in Large Systems at the Extreme Scale
Role: Senior Investigator.

2013 – 2017 Department of Energy – Advanced Scientific Computing Research
Environment for quantifying uncertainty: integrated and optimized at the extreme-scale
Role: Postdoc Research Associate.

2013 – 2015 Air Force Office of Scientific Research
Generalized Mathematical and Computational Methods for Predictive Simulation of Stochastic Turbulent Systems
Role: Postdoc Research Associate.

Honors and Awards

- SIAM Travel Award, Feb 2013.
- AMS Travel Award, Jan 2013.
- Andrew Mellon Predoctoral Fellow, University of Pittsburgh, 2011-2012.
- Scholarship for Excellence students, University of Science, Vietnam, 2002-2006.
- Honorable mention, Vietnam National Mathematical Olympiad, 2002.

Research Visits

- Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, Feb 5 – 16, 2018.
- Vietnam Institute for Advanced Study in Mathematics, Hanoi, Vietnam, Nov 14 – 25, 2016.
- Oak Ridge National Laboratory, Oak Ridge, TN, August 13 – 24, 2012.
- Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Nov 21 – Dec 16, 2011.

Selected Invited Talks

- Summer Meeting, University of Science, Ho Chi Minh City, Vietnam, July 2019.
- International Congress on Industrial and Applied Mathematics, Valencia, Spain, July 2019.
- Approximation Theory 16, Nashville, TN, May 2019.
- SIAM Conference on Computational Science and Engineering, Spokane, WA, February 2019.

- Computational and Applied Mathematics seminar, University of Pittsburgh, Pittsburgh, PA, October 2018.
- SIAM Annual Meeting, Portland, OR, July 2018.
- SIAM Conference on Uncertainty Quantification, Garden Grove, CA, April 2018.
- The 7th International Conference on High Performance Scientific Computing, Hanoi, Vietnam, March 2018.
- Workshop on *Surrogate Models for UQ in Complex Systems*, Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom, February 2018.
- Workshop on *Trends and Advances in Monte Carlo Sampling Algorithms*, the Statistical and Applied Mathematical Sciences Institute, Durham, NC, December 2017.
- ASCR PI Meeting, Rockville, MD, September 2017 (invited poster).
- SIAM Annual Meeting, Pittsburgh, PA, July 2017.
- Mathematics Colloquium, University of Idaho, Moscow, ID, April 2017.
- SIAM Conference on Computational Science and Engineering, Atlanta, GA, March 2017.
- CSMD Seminar, Oak Ridge National Laboratory, Oak Ridge, TN, January 2017.
- Analysis Seminar, University of Science, Ho Chi Minh City, Vietnam, December 2016.
- 4th Workshop on Sparse Grids and Applications, Miami, FL, October 2016.
- AMS Fall Western Sectional Meeting, Denver, CO, October 2016.
- Workshop on *Numerical Analysis and Predictability of Fluid Motion*, Pittsburgh, PA, May 2016.
- SIAM Conference on Uncertainty Quantification, Lausanne, Switzerland, April 2016.
- SIAM Conference on Analysis of Partial Differential Equations, Scottsdale, AZ, December 2015.
- International Congress on Industrial and Applied Mathematics, Beijing, China, August 2015.
- Computational Mathematics Seminar, University of Pittsburgh, PA, April 2015.
- SIAM SEAS 2015 Annual Meeting, Birmingham, AL, March 2015.
- Comp Math Seminar, Clemson University, March 2015.
- SIAM Conference on Uncertainty Quantification, Savannah, GA, April 2014.
- SIAM SEAS 2014 Annual Meeting, Melbourne, FL, March 2014.
- SIAM SEAS 2013 Annual Meeting, Knoxville, TN, March 2013.
- SIAM Conference on Computational Science and Engineering, Boston, MA, March 2013.

- CSMD Seminar Series, Oak Ridge National Laboratory, Oak Ridge, TN, August 2012.
- Workshop on *Numerical Methods for Coupled Problems*, University of Pittsburgh, May 2012.
- 8th International Conference on Scientific Computing and Applications, University of Nevada, Las Vegas, April 2012.
- Numerical Mathematics Seminar, WIAS, Berlin, December 2011.
- International Conference on Applied Mathematics, Modeling and Computational Science, Wilfrid Laurier University, Canada, July 2011.

Synergistic Activities

Symposia organizer

- (with Zachary Grant) Co-organizer of mini-symposium "Innovations and implementations of numerical methods for time dependent problems", SIAM SEAS 2019, Knoxville, TN, September 2019.
- (with Guannan Zhang) Co-organizer of mini-symposium "Advances in Sparse Polynomial Approximations with Applications to Complex Stochastic Modeling", SIAM UQ 2018, Garden Grove, CA, April 2018.
- (with Clayton Webster) Co-organizer of mini-symposium "Approximation of High-dimensional Systems – Theory and Numerical Aspects", SIAM AN 2017, Pittsburgh, PA, July 2017.
- (with Abdellah Chkifa, Clayton Webster, Guannan Zhang) Co-organizer of mini-symposium "Advances in Theoretical and Numerical Analysis of Parametrized PDEs in High Dimension", SIAM PDE 2015, Scottsdale, AZ, December 2015.

Technical reviewer

- Journals: *SIAM Journal on Numerical Analysis, Computers and Mathematics with Applications, Journal of Computational and Applied Mathematics, SIAM/ASA Journal on Uncertainty Quantification, SIAM Journal of Scientific Computing, Constructive Approximation, Journal of Scientific Computing, Numerical Methods for Partial Differential Equations, Advances in Numerical Analysis, IMA Information and Inference, Proceeding of the Royal Society A, Proceeding of the American Society of Mechanical Engineers, Applied Numerical Mathematics, Numerische Mathematik, Applied Mathematics Letters.*
- Proposals: Advanced Scientific Computing Research program (US Deparment of Energy).

Teaching Experience

Teaching Assistant

- Department of Mathematics, University of Pittsburgh, 2008-2013.
  Courses: *Calculus 2, Calculus 3, Intro Theory 1-Variable Calculus.*
- Department of Mathematics, University of Science, Vietnam, 2006-2008.
  Courses: *Calculus 1, Calculus 2, Real Analysis, Functional Analysis.*

Short course and guest lecturer

- Guest lecturer on *PDE-based Image Denoising*, Partial Differential Equations course, University of Tennessee Knoxville, TN, March 2019.

- Short course on *Uncertainty Quantification and Approximation Theory for Parameterized PDEs*, Vietnam Institute for Advanced Study in Mathematics, Hanoi, Vietnam, November 2016.

Ph.D. student mentor

- Joseph Daws Jr., Department of Mathematics, University of Tennessee Knoxville, 2018-2019.

- Nick Dexter, Department of Mathematics, University of Tennessee Knoxville, 2015-2018.

Computer Skills

- Programming languages: Python, MATLAB.

- Libraries/Packages: PyTorch, scikit-learn, FreeFem++, FEniCS.

- Other: LaTeX, Microsoft Office, HTML, Windows, MacOS.