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## Employment

- Department of Mathematics, Tufts University  
*Assistant Professor:* September 2014 - present
- Department of Mathematics, The Pennsylvania State University  
*Research Assistant Professor:* August 2013 - August 2014
- Department of Mathematics, The Pennsylvania State University  
*Postdoctoral Fellow:* August 2010 - August 2013  
Advisors: Professor James Brannick, Professor Jinchao Xu, and Professor Ludmil Zikatanov
- Beijing International Center of Mathematical Research  
*Visiting Scholar:* July 2009 - July 2010
- Department of Mathematics, The Pennsylvania State University  
*Visiting Scholar:* September 2007 - August 2008

## Education

- Ph.D in Computational Mathematics: June 2009, Zhejiang University  
Advisor: Professor Xiaoliang Cheng
- B.S. in Information and Computer Science: June 2004, Zhejiang University

## Publications and Manuscripts

### Under Review

1. *Optimal Interpolation and Compatible Relaxation in Classical Algebraic Multigrid*, with J. Brannick, F. Cao, K. Kahl, and R. Falgout, submitted to SIAM Journal of Scientific Computing, 2017.
2. *Adaptive Finite Element Method for fractional differential equations using Hierarchical Matrices*, with X. Zhao, W. Cai, and G. Karniadakis, submitted to Computer Methods in Applied Mechanics and Engineering, 2017.
3. *Weak Galerkin Method for the Biot's Consolidation Model*, with L. Mu and X. Ye, submitted to Computer & Mathematics with Applications, 2016.
4. *A Compatible High-order Meshless Method for the Stokes Equations with Applications to Suspension Flows*, with N. Trask and M. Maxey, submitted to Journal of Computational Physics, 2016.
5. *Vector-potential Finite-element formulations for Two-dimensional Resistive Magnetohydrodynamics*, with J. Adler, Y. He, and S. P. MacLachlan, submitted to Numerische Mathematik, 2016.
6. *Modeling Myeloma Cell Dynamics and Cytolysis in Microfluidic Droplets*, with S. Sarkar, P. Sabhachandani, J. Adler, D. Stroopinski, J. Rosenblatt, D. Avigan, and T. Konry, submitted to Scientific Reports, 2016.

## Refereed Publications

7. *A Simple Finite Element Method of the Cauchy Problem for Poisson Equation*, with L. Mu and X. Ye, International Journal of Numerical Analysis and Modeling, accepted.
8. *Algebraic Multigrid for Least Squares Problems on Graphs with Applications to HodgeRank*, with C. Colley, J. Lin, and S. Aeron, Graph Algorithms Building Blocks, 31st IEEE International Parallel and Distributed Processing Symposium, accepted.
9. *Multigrid Algorithms for hp-version Interior Penalty Discontinuous Galerkin Methods on Polygonal and Polyhedral meshes*, with P. F. Antonietti, P. Houston, M. Sarti, and M. Verani, Calcolo, accepted.
10. *On the Approximation of Laplacian Eigenvalues in Graph Disaggregation*, with J. C. Urschel and L. Zikatanov, Linear and Multilinear Algebra, accepted.
11. *Robust Solvers for Maxwell's Equations with Dissipative Boundary Conditions*, with J. Adler and L. Zikatanov, SIAM Journal of Scientific Computing, accepted.
12. *Numerical Studies of A Class of Linear Solvers for Fine-Scale Petroleum Reservoir Simulation*, with Z. Li, S. Wu, C.-S. Zhang, J. Xu, and C. Feng, Computing and Visualization in Science, 18(2), 93-102, 2017.
13. *A Nonconforming Finite Element Method for the Biot's Consolidation Model in Poroealsticity*, with C. Rodrigo, J. Gaspar, and L. Zikatanov, Journal of Computational and Applied Mathematics, 310, 143-154, 2017.
14. *Compact Moving Least Squares: An Optimization Framework for Generating High Order Compact Meshless Discretizations*, with N. Trask and M. Maxey, Journal of Computational Physics, 326, 596-611, 2016.
15. *Robust Preconditioners for Incompressible MHD Models*, with Y. Ma, K. Hu, and J. Xu, Journal of Computational Physics, 316, 721-746, 2016.
16. *A Two-grid SA-AMG Convergence Bound that Improves When Increasing the Polynomial Degrees*, with P. Vassilevski and J. Xu, Numer. Linear Algebra Appl., 23(4), 746-771, 2016.
17. *Fast Multilevel Solvers for A Class of Discrete Fourth Order Parabolic Problems*, with B. Zheng, L.P. Chen, L. Chen, R.H. Nochetto, and J. Xu, Journal of Scientific Computing, 69(1), 201-226, 2016.
18. *Stability and Monotonicity for Some Discretizations of the Biot's Consolidation Model*, with C. Rodrigo, J. Gaspar, and L. Zikatanov, Computer Methods in Applied Mechanics and Engineering, 298(1), 183-204, 2016.
19. *A Finite Element Framework for Some Mimetic Finite Difference Discretizations*, with C. Rodrigo, F.J. Gaspar, and L. Zikatanov, Computers & Mathematics with Applications, 70(11):2661-2673, 2015.
20. *On Robust and Efficient Parallel Reservoir Simulation on Tianhe-2*, with W. Guan, C. Qiao, H. Zhang, C.-S. Zhang, M. Zhi, Z. Zhu, Z. Zheng, W. Ye, Y. Zhang, Z. Li, C. Feng, Y. Xu, and J. Xu, SPE Reservoir Characterization and Simulation Conference and Exhibition, SPE 175602-MS, 2015.
21. *A Multigrid Solver based on Distributive Smoother and Defect Correction for Oseen Problems*, with L. Chen, M. Wang, and J. Xu, Numerical Mathematics: Theory, Methods and Applications, 8(2), 237-252, 2015.
22. *Local Fourier Analysis of Multigrid Methods with Polynomial Smoothers and Aggressive Coarsening*, with J. Brannick, C. Rodrigo, and L. Zikatanov, Numerical Mathematics: Theory, Methods and Applications, 8(1), 1-21, 2015.

23. *A Cascadic Algorithm for Computing the Fiedler Vector of Graph Laplacians*, J. Urschel, J. Xu, and L. Zikatanov, *Journal of Computational Mathematics*, 33(2), 209-226, 2015.
24. *Two-Grid Method for Maxwell Eigenvalue Problems*, with J. Zhou, L. Chen, S. Shu, and L. Zhong, *SIAM Journal on Numerical Analysis*, 52(4), 2027-2047, 2014.
25. *On Adaptive Eulerian-Lagrangian Method for Linear Convection-Diffusion Problems*, with Y.-J. Lee, J. Xu, and C.-S. Zhang, *Journal of Scientific Computing*, 58(1), 90-114, 2014.
26. *Application of Auxiliary Space Preconditioning in Field-Scale Reservoir Simulations*, with J. Xu and C.-S. Zhang, *SCIENCE CHINA Mathematics*, 56(12), 2737-2751, 2013.
27. *A Parallel Auxiliary Grid Algebraic Multigrid Method for Graphic Processing Units*, with L. Wang, J. Cohen, and J. Xu, *SIAM Journal on Scientific Computing*, 35(3), C263-C283, 2013.
28. *Comparative Convergence Analysis of Nonlinear AMLI-cycle Multigrid*, with P. Vassilevski and J. Xu, *SIAM Journal on Numerical Analysis*, 51(2), 1349-1369, 2013.
29. *Parallel Unsmoothed Aggregation Algebraic Multigrid Algorithms on GPUs*, with J. Brannick, Y. Chen, and L. Zikatanov, *Proceedings of Symposium in honor of Raytcho Lazarov's 40 years research in Computational Methods and Applied Mathematics*, Springer Proceedings in Mathematics and Statistics, Vol. 45, 2013.
30. *Combined Preconditioning with Applications in Reservoir Simulation*, with S. Wu, X. Wu, J. Xu, C.-S. Zhang, S. Zhang, and L. Zikatanov, *Multiscale Modeling and Simulation*, 11(2), 507-521, 2013.
31. *Development of a Fast Auxiliary Subspace Preconditioner for Numerical Reservoir Simulators*, with W. Liu, G. Qin, J. Xu, and C.-S. Zhang, *SPE Reservoir Characterization and Simulation Conference and Exhibition*, SPE 148388, 2011.
32. *Effects of Integrations and Adaptivity for the Eulerian-Lagrangian Method*, with J.-W. Jia, J. Xu and C.-S. Zhang, *Journal of Computational Mathematics*, 29:367-395, 2011.
33. *Acceleration of Two-grid Method for Eigenvalue Problems*, with X.-L. Cheng, *Mathematics of Computation*, 80:1287-1301, 2011.
34. *The Boundary Penalty Method for the Diffusion Equation Subject to the Specification of Mass*, with L. Zhao and A. W. Shaikh, *Applied Mathematics and Computation*, 186(1):735-748, 2007.
35. *Preconditioners for Elliptic Problems via Nonuniform Meshes*, with X.-F. Ling, *Applied Mathematics and Computation*, 181(2):1182-1198, 2006.
36. *On the Iterative Algorithm for Large Sparse Saddle Point Problems*, with X.-F. Ling, *Applied Mathematics and Computation*, 178(2):372-379, 2006.

### Technical Reports

1. *Microphysics of Neutron Star Outer Envelopes in the Periodized, Magnetic Thomas-Fermi Model*, with T.A. Engstrom, V.H. Crespi, B.J. Owen, and J. Brannick, Technical Report, Tufts University, 2015.

### Manuscripts in Progress

1. *Fast Solver For Some Drift-Diffusion and Electrokinetic Equations*, with M. Metti and J. Xu.
2. *Randomized and Fault-tolerant Method of Subspace Corrections*, with J. Xu and L. Zikatanov.
3. *Time Adaptive Parareal Algorithm*, with J. Xu, and C.-S. Zhang.

### Grants

- NSF Grant, *Robust Solvers for Coupled Problems with Applications to Electromagnetism and Poromechanics*, 09/15/2016 - 08/31/2019, PI.
- DOE ASCR Grant, *Collaboratory on Mathematics for Mesoscopic Modeling of Materials*, 11/01/2012 - 10/31/2014, Co-PI with J. Xu (PI).
- NSF Grant, *Collaborative Research: Special Session on Numerical Modeling of Fluids and Structures*, 05/01/2013 - 09/01/2013, PI.

## Honors and Awards

- 2016: Best Performer of Disease Module Identification DREAM Challenges (Team Tusk: Jake Crawford, Junyuan Lin, Xiaozhe Hu, Benjamin Hescott, Donna Slonim, Lenore Cowen)
- 2016: Reimann-Louville Award for best application paper at the International Conference on Fractal Differentiation and Its Applications 2016 (paper title: “*Fast Solver for Fractional Differential Equations based on Hierarchical Matrices*”)
- 2015: Workshop: Numerical Methods for Large-Scale Nonlinear Problems and Their Applications, financial support, Brown University, Institute for Computational and Experimental Research in Mathematics, and National Science Foundation
- 2014: Workshop: Robust Discretization and Fast Solvers for Computable Multi-Physics Models, financial support, Brown University, Institute for Computational and Experimental Research in Mathematics, and National Science Foundation
- 2012: Oberwolfach Seminars: Subspace Correction Methods, financial support
- 2012: NSF/CBMS Conference: Finite Element Exterior Calculus, financial support, Brown University, Institute for Computational and Experimental Research in Mathematics, and National Science Foundation
- 2012: Frontier of Computational and Applied Mathematics, financial support, University of California, Los Angeles, and Institute for Pure and Applied Mathematics
- 2011: 20th International Domain Decomposition Conference, financial support, University of California, San Diego & National Science Foundation
- 2009: Outstanding Ph.D. Graduate of Zhejiang Province, Department of Education, China
- 2009: Outstanding Ph.D. Graduate of Zhejiang University, Zhejiang University
- 2008: Center of Nonlinear Analysis Summer School Traveling Fund, Carnegie Mellon University
- 2007-2008: National Scholarship of the Studying Abroad Program for Building High Level University, Department of Education, China
- 2004: Samsung Scholarship Award, Samsung Corporation

## Invited Talks

- *Efficient Simulation of Asymptotically Disappearing Solutions for Wave Equations*, SIAM conference on Computational Science and Engineering, Atlanta, 02/28/2017.
- *Robust Preconditioners for Coupled Problems*, **Plenary talk** at International Conference on Domain Decomposition Methods, Svalbard, Norway, 02/07/2017
- *Fast Graph Laplacian Solvers and Their Applications in Protein Interaction Networks*, Applied and Computational Mathematics Seminar, University of California, Irvine, 12/05/2016.
- *Fast Graph Laplacian Solvers and Their Applications*, CCMA Colloquium, The Pennsylvania State University, 11/28/2016.

- *Distance Metrics for Protein Interaction Networks*, CCMA Luncheon Seminar, The Pennsylvania State University, 11/28/2016.
- *Weak Galerkin Finite Element Method for the Biot's Consolidation Model*, The 2nd Annual Meeting of SIAM Central States Section, University of Arkansas at Little Rock, 10/01/2016.
- *Randomized Method of Subspace Corrections*, CCMA PDEs and Numerical Methods Seminar, Penn State University, 06/28/2016.
- *Nonconforming Three-field Discretization of Biot's Model in Poroelasticity*, 8th International Conference on Porous Media & Annual Meeting, Cincinnati, Ohio, USA, 05/09/2016.
- *Convergence Analysis of Finite Element Discretizations for Biot's Equations*, Workshop "Flow in Deformable Porous Media", Universidad de Zaragoza, 11/25/2015.
- *Finite Element Multigrid Framework for Mimetic Finite Difference Discretizations*, Polytopal Element Methods in Mathematics and Engineering, Georgia Institute of Technology, October 28, 2015.
- *Effective Solvers for Reservoir Simulation*, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Stanford University, 06/29/2015.
- *Algebraic Multigrid Method and Its Parallelization*, Computational Science Seminar, University of Massachusetts Dartmouth, 04/29/2015.
- *Cascadic Multigrid for Eigenvalue Problems and Its Application in Graph Problems*, Mathematics Colloquium, Tufts University, 04/17/2015.
- *Robust Preconditioners for the Incompressible MHD System*, Scientific Computing Seminar, Brown University, 03/27/2015.
- *Finite Element Multigrid Framework for Mimetic Finite Difference Discretizations*, SIAM Conference on Computational Science and Engineering, Salt Lake City, 03/14/2015.
- *On Adaptive Eulerian-Lagrangian Method for Linear Convection-Diffusion Problems*, AMS Spring Central Sectional Meeting, Texas Tech University, 04/12/2014.
- *Effective Solvers for Reservoir Simulation*, Tufts University, 02/12/2014.
- *Effective Solvers for Reservoir Simulation*, Lawrence Livermore National Laboratory, 11/25/2013.
- *Cascadic Multigrid for Eigenvalue Problems and Its Application in Graph Problems*, Applied and Computational Mathematics Seminar, University of California, Irvine, 09/20/2013.
- *Parallel AMG Method on GPU*, 21st International Domain Decomposition Conference, INRIA, Rennes, France, 06/26/2012.
- *Parallel Auxiliary Grid AMG Method for GPU*, Applied and Computational Mathematics Seminar, University of California, Irvine, 05/07/2012.
- *Algebraic Multigrid Methods for Petroleum Reservoir Simulation*, 8th International Conference on Scientific Computing and Applications, University of Nevada, Las Vegas, 04/03/2012.
- *Effective Preconditioners for Reservoir Simulation*, Computational and Applied Mathematics Colloquium, Department of Mathematics, The Pennsylvania State University, 01/13/2012.
- *Effective Solvers for Reservoir Simulation*, Workshop 4: Numerical Analysis of Multiscale Problems & Stochastic Modeling, Linz, Austria, 12/14/2011.
- *Effective Solvers for Reservoir Simulation*, Numerical Analysis and PDE Seminar, Department of Mathematics, University of Delaware, 11/10/2011.
- *Comparative Convergence Analysis of Nonlinear AMLI-cycle Multigrid*, 8th International Conference on Large-Scale Scientific Computations, Sozopol, Bulgaria, 06/07/2011.

- *Fast Solvers for Reservoir Simulation*, 20th International Domain Decomposition Conference, University of California, San Diego, USA, 02/08/2011.

## Contributed Talks

- *Finite Element Framework for Mimetic Finite Difference Discretizations*, 2016 SIAM Annual Meeting, Boston, 07/13/2016.
- *Efficient Solvers for Asymptotically Disappearing Solutions of Maxwell's Equations*, The 14th Copper Mountain Conference on Iterative Methods, 03/22/2016.
- *Convergence Analysis of Finite Element Discretizations for Biot's Equations*, The 8th International Congress on Industrial and Applied Mathematics, 08/11/2015.
- *Convergence Analysis of Finite Element Discretizations for Biot's Equations*, The 10th International Conference on Large-Scale Scientific Computations, 06/09/2015.
- *Adaptive Eulerian-Lagrangian Method for Convection-Diffusion Problems*, Finite Element Circus, University of Delaware, 10/19/2013.
- *Comparative Convergence Analysis of Nonlinear AMLI-cycle Multigrid*, Finite Element Circus, Rutgers University, New Jersey, 04/14/2012.
- *Adaptive Eulerian-Lagrangian Method for Convection-Diffusion Problems*, Workshop on Multi-level and Adaptive Methods, Beijing International Center of Mathematical Research & Peking University, Beijing, China, 08/29/2009.

## Synergistic Activities

- Faculty Advisor for SIAM Student Chapter: Department of Mathematics, Tufts University, June 2015-Present.
- Member of Academic Review Board: School of Arts and Sciences, Tufts University, 2014-Present.
- Graduate Committee Member: Department of Mathematics, Tufts University, 2014-Present.
- Scientific Committee Member:
  - 11th International Conference on Large-Scale Scientific Computations, 06/05/2017 - 06/09/2017, Sozopol, Bulgaria.
  - 10th International Conference on Large-Scale Scientific Computations, 06/08/2015 - 06/12/2015, Sozopol, Bulgaria.
- Summer School Organizer:
  - Summer School on Finite Element Methods, 08/04/2015 - 08/07/2015, Beijing Center for Scientific and Engineering Computing, Beijing University of Technology, Beijing, China
- Workshop Organizer:
  - Workshop on Finite Element Methods, 08/08/2015 - 08/09/2015, Beijing Center for Scientific and Engineering Computing, Beijing University of Technology, Beijing, China
- Minisymposium Organizer:
  - *Advanced Discretizations and Solvers for Couples Systems of Partial Differential Equations*, 11th International Conference on Large-Scale Scientific Computations, 06/05/2017-06/10/2015, Sozopol, Bulgaria.
  - *Novel Numerical Methods for Maxwells Equations and Magnetohydrodynamics*, 2017 SIAM Conference on Computational Science and Engineering, 02/27/2017-03/03/2017, Atlanta, USA.

- *Robust Solvers for Multiphysics Problems*, the 24th International Conference on Domain Decomposition Methods, 02/06/2017-02/10/2017, Svalbard, Norway
- *Novel Numerical Methods on Polyhedral Meshes*, 2016 SIAM Annual Meeting, 07/11/2016-07/16/2016, Boston, USA.
- *Numerical Simulations in Poromechanics*, 8th International Congress on Industrial and Applied Mathematics, 08/10/2015-08/14/2015, Beijing, China.
- *Numerical Methods for Multiphysics Problem*, 10th International Conference on Large-Scale Scientific Computations, 06/08/2015 - 06/12/2015, Sozopol, Bulgaria.
- *Numerical Modeling of Fluids and Structures*, 9th International Conference on Large-Scale Scientific Computations, 06/03/2013 - 06/07/2013, Sozopol, Bulgaria.
- Reviewer for Department of Energy: Small Business Innovation Research Program, DOE office of Advanced Scientific Computing Research, 2012 - 2016.
- Editorial Board: Petroleum Science, 2015 - present
- Referee for Various Journals: e.g. SIAM Journal on Numerical Analysis (SINUM), SIAM Journal on Scientific Computing (SISC), Multiscale Modeling and Simulation (MMS), Mathematics of Computation (Math. Comp.), Numerische Mathematik (Num. Math.), Computer Methods in Applied Mechanics and Engineering (CMAME), Numerical Linear Algebra and Applications (NLAA), Mathematical Models and Methods in Applied Sciences (M3AS), Applicable Analysis (AA), Advances in Applied Mathematics and Mechanics (AAMM), Advances in Computational Mathematics (ACOM), Applied Mathematical Modeling (AMM), BIT Numerical Mathematics (BITN), Computers and Mathematics with Applications (CAMWA), International Journal of Computer Mathematics (IJCM), Journal of Computational and Applied Mathematics (JCAM), Journal of Numerical Methods of Partial Differential Equations (NMPDE), Petroleum Science (PetroSci), and other proceeding journals.
- Doctoral Dissertation Defense Committee Member: David Emerson (Tufts University, 2015), Thomas Berson (Tufts University, 2015), Meghan O’Connell (Tufts University, 2016), Qiong Wu (Tufts University, 2016), Jiani Zhang (Tufts University, 2017), Melody Takeuchi (Tufts University, 2017), Xiao Xiao (Mechanical Engineering Department, Tufts University, 2017)
- Graduate Students: Junyuan (Joanne) Lin (Tufts University, 2014 - present), Peter Ohm (Tufts University, 2015 - present), Charles Colley (Master, Tufts University, 2016 - present)
- Undergraduate Students: Charles Colley (Senior Honors Thesis, Tufts University, 2015 - 2016), Hanyao Zhang (Senior Honors Thesis, Tufts University, 2015 - 2016)

## Teaching Experiences

- Spring 2016, Tufts University, MATH 205: *Graph Algorithms*
- Spring 2016, Tufts University, MATH 34: *Calculus II*
- Fall 2015, Tufts University, MATH 226: *Numerical Analysis*
- Fall 2015, Tufts University, MATH 34: *Calculus II*
- Spring 2015, Tufts University, MATH 128: *Numerical Linear Algebra*.
- Spring 2015, Tufts University, MATH 34: *Calculus II*.
- Fall 2014, Tufts University, MATH 126: *Numerical Analysis*.
- Fall 2012, Penn State University, MATH 441: *Matrix Algebra*.
- Spring 2012, Penn State University, MATH/CMPSC 456: *Introduction of Numerical Analysis II*.

- Fall 2011, Penn State University, MATH/CMPSC 455: *Introduction of Numerical Analysis I*.
- Spring 2011, Penn State University, MATH/CMPSC 451: *Numerical Computations*.
- Fall 2010, Penn State University, MATH 250: *Ordinary Differential Equations*.