

Brief excerpt:

- **Ph.D, 1988**, Mathematics, Carnegie Mellon University
- Current Position: **Fu Foundation Professor of Applied Mathematics** (2014-), Chair of Applied Mathematics Program (2015-2020); co-Chair of Center of Computing Systems for Data-driven Science (2019-2024), co-Chair of Center of Foundation of Data Science (2018-2019), Data Science Institute, Columbia University.
- Other Positions: **Verne M. Willaman Professor of Mathematics**, Penn State University (2006-2015); Tsunoda Senior Fellow, Waseda University (2023); Columbia-Paris Alliance Professor (2022).
- **US Association Computational Mechanics Thomas J.R. Hughes Medal** (2021). **SIAM Review SIGEST paper award** (2020). **SIAM outstanding paper prize** (2016); **ACM Gordon-Bell prize finalist** (2016); **Feng Kang Prize, in Scientific Computing**, (2005). **SIAM Fellow**. **AAAS Fellow**. **AMS Fellow**.
- Founding Co-Editor-in-Chief, **Communications of the American Mathematics Society** (2020-); Editor-in-Chief, **SIAM Journal on Applied Mathematics** (2021-); Associate Editors of **SIAM J. Numer. Anal.** (2003-2012, 2014-2023), **SIAM J. Appl Math** (2012-2020) **Math of Computation** (AMS, 2016-2024); Member of editorial boards of 12 other journals such as **M3AS, DCDS-B, CMS, JCM, CiCP, NMTMA, IFB, CMAC, JMS, JPNM, CTAM**, etc. Series Editor of **Handbook of Numerical Analysis** (2015-).
- Chair of **AMS Fellow Selection Committee** (2022). Chair, **SIAM** activity group on mathematical aspects of materials science (2014-2016). SIAM Representative to the **U.S. National Committee on Theoretical & Applied. Mechanics** (USNC/TAM, 2015-2019), Council Member, **American Mathematical Society** (2023-). Member of **Prize Selection Committees** for various **SIAM** and **USACM** major prizes (2014-2023). Co-Organizer, Machine Learning in Science and Engineering (MLSE 2020). Member of Scientific Program Committee, **ICIAM** 2019. Conference Co-chair, **WCCM** 2018. Conference Co-chair, **SIAM** Conference on Mathematical Aspects of Materials Science (2016).
- Research areas: applied and computational mathematics; numerical algorithms and scientific computation, selected applications in physical, biological, materials sciences, information sciences, and machine learning.
- Over 320 refereed publications: 280+ in professional journals, 40+ in proceedings/book-chapters, 1 book.
- Published in many disciplinary fields such as computational and applied mathematics, modeling and analysis, atmospheric, computer, imaging and materials sciences, atomic, biological, and condensed matter physics, data science and machine learning, biomedical and mechanical engineering, etc.
- Over 22300 Google Scholar citations with an H-index of 77 and 12200 SCI citations with an H-index of 57.
- 27 former Ph.D. students graduated (including US **NSF** Career Award grantees, **AWM** dissertation prize awardee, **Sloan Fellowship** awardee). Supervised 18 post-doc scholars, and 9 M.S. students
- Over 490 invited lectures given at conferences and academic institutions; Tutorials at IMA, IMS, BCAM, etc. **NSF-CBMS** distinguished speaker (10 lectures, 2017), Invited speaker at the **International Congress of Mathematicians** (ICM, 2018). SIAM Invited Address at the Joint Mathematics Meetings (**JMM** 2022).

(a) Professional Preparation

1986 - 1988 **Ph.D.**, Mathematics, Carnegie Mellon University, Pittsburgh, PA
1984 - 1986 **M.S.**, Applied Mathematics, Carnegie Mellon University, Pittsburgh, PA
1980 - 1983 **B.S.**, Mathematics, Univ. of Sci. and Tech. of China, Hefei, China

(b) Research Interests: Applied and Computational Mathematics

Applied and numerical analysis, scientific computation

numerical analysis, applied analysis and PDEs, multiscale models, adaptive algorithms

Selected applications in physical, biological, and materials sciences

superfluids, vortices, complex fluids, membranes, phase transformations, rare events

Selected applications in information sciences

data mining, model reduction, meshing, tessellations and image analysis, machine learning

(c) Appointments

2014 - present **Fu Foundation Professor of Applied Mathematics**,
Fu Foundation School of Engineering and Applied Science, Columbia University
2019 - present Co-Chair of Center for Computing Systems for Data-driven Science
Data Science Institute, Columbia University
2015 - 2020 Chair of Applied Mathematics Program, Columbia University
2014 - present **Affiliated Faculty**, Data Science Institute, Columbia University
2018 -2019 Co-Chair of Center for Foundation of Data Science, Data Science Institute, Columbia U.
2006 - 2015 **Verne M. Willaman Professor** of Mathematics, Penn State University
2005 - 2015 **Professor**, Dept. of Materials Sciences, Penn State University
2001 - 2006 **Professor**, Dept. of Math., Penn State University
1996 - 2002 **Senior Lecturer and Full Prof.**, Dept. of Math., HK Univ. of Sci. & Tech.
1997 & 1999 **Associate and Full Prof.**, Dept. of Math., Iowa State University
1994 - 1995 **Associate Professor with tenure**, Dept. of Math., Michigan State University
1990 - 1994 **Assistant Professor**, Dept. of Math., Michigan State University
1988 - 1990 **L. E. Dickson Instructor**, Dept. of Math., University of Chicago
1984 - 1988 Teaching and Research Assistant, Carnegie Mellon University
1984 Summer Faculty of Mathematics, University of Science and Technology, China

(d) Selected visiting, adjunct, and honorary positions in recent years

2023 Columbia's Tsunoda Senior Fellow, Waseda University, Tokyo, Japan.
2022 Columbia-Paris Alliance Visiting Professor, Ecole Polytechnique, Paris, France.
2020-2023 Inaugural Feng Kang Scholar, AMSS, Chinese Academy of Sciences.

(e) Honors and Awards:

• **Awards received** from institutions:

2007 Recipient of the **Eberly College of Science Medal**, Penn State University;
2000 Co-recipient of the **Liberal Arts and Sciences Award for outreach/extension**, ISU;
1992 Recipient of **Frame Faculty Teaching Award**, Michigan State University;
1988 Recipient of 1987 **J. D. Liang Fellowship**, Carnegie Mellon University.

• **External honors/awards received:**

2023 **Winner of Smart Cities North America Awards**, awarded by the IDC Government insight, for the *Digital Twin of New York City* project led by the NSF project team at Columbia University;
2021 **US Association of Computational Mechanics Thomas J.R. Hughes Medal**, USACM, for numerous innovative contributions to computational physics and computational fluid mechanics, and unwavering service to the scientific computing community;
2020 **SIAM Review SIGEST paper award**, SIAM,

for a paper published in *SIAM Journal on Numerical Analysis* in 2014,
coauthored with former Ph.D student Xiaochuan Tian.

- 2019 **Feng-Kang Visiting Scholar**, Institute of Computational Mathematics and Scientific and Engineering Computing, Chinese Academy of Sciences;
- 2017 **Inaugural excellent paper prize**, SCIENTIA SINICA,
for a 2015 paper published in SCIENTIA SINICA Mathematica,
(Chinese Edition);
- 2016 **SIAM outstanding paper prize**, SIAM,
for a paper published in *SIAM Journal on Numerical Analysis*,
co-authored with former Ph.D student Xiaochuan Tian in 2013;
- 2008 **Outstanding research team award**
for 973 project *Large Scale Scientific Computation Research*
(as the team's Chief Scientist), China Ministry of Science and Technology;
- 2005 Recipient of the **Feng Kang Prize in Scientific Computing**.

• **Other External Recognitions:**

- 2022 **SIAM Invited Address at the Joint Mathematics Meetings**.
- 2022/2023 Top 200 best mathematicians worldwide ranked by Research.com.
- 2018 **International Congress of Mathematicians Invited Speaker**, ICM2018.
- 2016 **ACM Gordon-Bell prize finalist**;
for largest and fastest 3D phase field microstructure coarsening simulations
(co-authored with former postdoc Dr.Jian Zhang, lead author, and other team members).
- 2019 **AMS Fellow**, Class of 2020,
for contributions to applied and computational mathematics with applications in materials science,
computational geometry, and biology.
- 2017 **AAAS Fellow**, Class of 2017,
for distinguished contributions to the field of applied and computational mathematics, particularly
for theoretical analysis and numerical simulations of mathematical models in various
applications.
- 2013 **SIAM Fellow**, Class of 2013,
for contributions to applied and computational mathematics with applications in materials science,
computational geometry, and biology.

(f) **Service:**

• **Chief Editors:**

- Founding Co-Editor-in-Chief (2020–), **Communications of the American Mathematical Society**,
published by the American Mathematical Society.
- Editor-in-Chief (2021–, Section Editor 2015–, Associated Editor 2012–),
SIAM Journal on Applied Math.,
published by SIAM.

• **Editorial boards:**

- Associate Editor (2003–2012, 2014–2024), **SIAM Journal on Numerical Analysis**,
published by SIAM.
- Associate Editor (2016–2024), **Mathematics of Computation**,
published by the American Mathematical Society.
- Associate Editor (2000–2005, 2018–), **Journal of Computational Mathematics**,
published by CAS and VSP.
- Associate editor (2018–), **Mathematical Models and Methods in Applied Sciences**,
published by World Scientific.
- Member of editorial board (2006–), **Discrete and Continuous Dynamical Systems - B**,
published by the American Institute of Mathematical Sciences.

- Member of editorial board (2009–), **Journal of Mathematical Research and Applications**, published by the DLUT.
- Associate editor (2017–), **Interfaces and Free Boundaries**, published by the European Mathematics Society.
- Member of editorial board (2019–), **Calcolo**, published by Springer.
- Member of the editorial board (2012–), **Communications in Mathematics and Statistics**, published by Springer and USTC.
- Member of the editorial board (2013–), **Journal of Mathematical Study**, published by Global Science Press and Xiamen University.
- Member of the editorial board (2014–), **Communications in Mathematical Sciences**, published by the International Science Press.
- Associate editor (2018–), **Journal of Peridynamics and Nonlocal Modeling**, published by Springer;
- Member of the editorial board (2018–), **Communication on Applied Math. and Computation**, published by Springer;
- Associate editor (2019–), **CSIAM Transaction on Applied Mathematics**, published by the Global Science Press.
- Editor of book series (2015–), **Handbook of Numerical Analysis**, published by Elsevier.
- Editor of book series (2021–2025), **SIAM Mathematical Modeling and Computation Book Series**, published by SIAM.
- Section Editor (2015–2020), **SIAM Journal on Applied Mathematics**, published by SIAM.
- Member of the editorial board (2016–2022), **Journal of Scientific Computing**, published by Springer.
- Associate Editor (2012–2015), **SIAM Journal on Applied Mathematics**, published by SIAM.
- Associate editor (2010–2020), **Communications in Computational Physics**, published by the Global Science Press.
- Associate editor (2009–2020), **Numerical Mathematics: Theory, Methods and Applications**, published by the Springer and Global Science Press.
- Editor (2002–2016), **Applied Mathematics Research eXpress**, published by the Oxford University Press.
- Member of the editorial board (2002–2007), **Chinese Journal of Computational Physics**, published by Global Science Press.
- Member of the editorial board (2004–2007), **Journal of Information and Computational Science**, published by Binary Information Press, USA.
- Member of the editorial board (2001–2005), **Communications in Pure and Applied Analysis**, published by the American Institute of Mathematical Sciences.
- **Services in Professional Societies:**
 - 2023–2024 **SIAM Task Force on the Future of Computational Science.**
 - 2023–2024 **USACM Thomas Hughes Medal Selection Committee.**
 - 2023–2025 **AMS Council member,**
 - 2022–2023 **SIAM Ralph E. Kleinman Prize Selection Committee.**
 - 2021–2023 **SIAM Committee on Science Policy.**
 - 2021–2023 **ICIAM Maxwell Prize Subcommittee.**
 - 2021 **Chair, AMS Fellows Selection Committee.**
 - 2021–2022 **SIAM Committee on Mathematical Modeling and Computation Book Series.**
 - 2020–2023 **AMS Fellows Selection Committee.**

- 2020 **Nomination Committee** for Officers of SIAG-MS (SIAM Activity Group on Mathematics for Materials Science).
- 2020 **Nomination Committee** for Officers of SIAG-APDE (SIAM Activity Group on Applied Partial Differential Equations).
- 2020-**EMI Committee on Machine Learning in Mechanics.**
- 2019-2021 **SIAM Prize Selection Committee for the John von Neumann Lecture.**
- 2019-**SIAM Journal Review Committee for Multiscale Modeling and Simulations.**
- 2018-2020 **SIAM Fellows Canvassing Committee.**
- 2018-2019 **SIAM News Editorial Board**, Liaison for Activity Group in Materials Science (SIAG-MS).
- 2016 **Nomination Committee** for Officers of SIAG-MS (SIAM Activity Group on Mathematical Aspects of Materials Science).
- 2015-2019 **Member and SIAM Representative to USNC-TAM** (US National Committee on Theoretical and Applied Mechanics), the National Academies.
- 2014-2016 **Chair of SIAG-MS** (SIAM Activity Group on Mathematical Aspects of Materials Science), elected.
- 2014-2018 **Member of the 9th Council**, Chinese Computational Mathematics Society (CMS).
- 2014-2015 **Chair of SIAM Peter Henrici Prize Selection Committee.**
- 1998-2002 **Standing Committee member**, the 5th Council of Chinese CMS.

(g) Mentoring and Student Training:

- 27 Former Ph.D. students supervised, (including US NSF Career Award grantees, AWM dissertation prize awardee, Sloan Fellowship awardee). See www.genealogy.math.ndsu.nodak.edu/id.php?id=15587 for an incomplete list. Supervised 18 post-doc scholars, and 9 M.S. students.

(h) Publications:

- Over 320 refereed publications (280+ in professional journals, 40+ in conference proceedings and book-chapters, 1 research monograph).
- Over 22300 Google Scholar citations with an H-index 77 and 12000 SCI citations with an H-index 57.
- Published in many disciplinary fields including computational and applied mathematics, atmospheric, computer, imaging, and materials sciences, atomic, biological and condensed matter physics, biomedical and mechanical engineering, etc.
- Selected publications: (full list of publications available at www.columbia.edu/~qd2125)

Book

- *Nonlocal Modeling, Analysis and Computation*, **CBMS-NSF Regional Research Conference Series**, Vol 94, SIAM, 2019.

Selected Refereed Journal Publications

- *Revealing excited states of rotational Bose-Einstein condensates*, with J. Yin, Z. Huang, Y. Cai and L. Zhang, **The Innovation**, 5, 100546, 2024.
- *Minimizing optimal transport for functions with fixed-size nodal sets*, with A. Sagiv, **J. Nonlinear Sci.**, 33, 95, 2023.
- *Bifurcation and fission in the liquid drop model: a phase-field approach*, with Z. Xu, **J. Math. Phys.**, 64, 071508, 2023.
- *Nonlocal trace spaces and extension results for nonlocal calculus*, with X. Tian, C. Wright and Y. Yu, **J. Functional Analysis**, 282, 109453, 2022.
- *Automated discovery of fundamental variables hidden in experimental data*, with B. Chen, K. Huang, S. Raghupathi, I. Chandratreya and H. Lipson, **Nature Computational Sci.**, 2, 433-442, 2022.
- *A physics-informed deep learning paradigm for traffic state estimation and fundamental diagram estimation*, with R. Shi, Z. Mo, K. Huang, and X. Di, **IEEE Transactions on Intelligent Transportation Systems**, 23, 11688-11698, 2022.

- *Stability of a nonlocal traffic flow model for connected vehicles*, with K Huang, **SIAM J. Appl. Math.**, 82, 221-243, 2022.
- *Maximum bound principles for a class of semilinear parabolic equations and exponential time differencing schemes*, with L. Ju, X. Li and Z. Qiao, **SIAM Review**, 63, 317-359, 2021.
- *Discovery of dynamics using linear multistep methods*, with R. Keller, **SIAM J. Numer. Anal.**, 59, 429-455, 2021.
- *Numerical methods for nonlocal and fractional models*, with M. D’Elia, C. Glusa, M. Gunzburger, X. Tian and Z. Zhou, **Acta Numerica**, 29, 1-124, 2020.
- *Mathematics of Smoothed Particle Hydrodynamics via a study of nonlocal Stokes equations*, with X. Tian, **Foundation of Computational Mathematics**, 20, 801-826, 2020.
- *Asymptotically compatible schemes for robust discretization of parametrized problems with applications to nonlocal models*, with X. Tian, **SIAM Review**, 62 (1), 199-227, 2020. (SIAM Review SIGEST Award).
- *Asymptotically compatible SPH-like particle discretizations of one dimensional linear advection models*, with H. Lee, **SIAM J. Numerical Analysis**, 57, 127-147, 2019.
- *New error bounds for deep ReLU networks using sparse grids*, with H. Montanelli, **SIAM Journal on Mathematics of Data Science**, 1, 78-92, 2019.
- *An invitation to nonlocal modeling, analysis and computation*, **Proceedings of the International Congress of Mathematicians (ICM 2018)**, 3, 3523–3552, 2018.
- *Stability of nonlocal Dirichlet integrals and implications for peridynamic correspondence material modeling*, with X. Tian, **SIAM J. Appl. Math.**, 78, 1536-1552, 2018.
- *Nonlocal neural networks, nonlocal diffusion and nonlocal modeling*, with Y. Tao, Q. Sun, and W. Liu, In **Advances in Neural Information Processing Systems (NIPS2018)**, 494-504, 2018.
- *Trace theorems for some nonlocal energy spaces with heterogeneous localization*, with X. Tian, **SIAM J. Math. Anal.**, 49, 1621-1644, 2017.
- *Recent developments in computational modeling of nucleation in phase transformations*, with L. Zhang, W.-Q. Ren and A. Samanta, **npj Computational Materials**, 2, 16003, 2016.
- *Extreme-scale phase field simulations of coarsening dynamics on the sunway taihulight supercomputer*, with J. Zhang, C. Zhou, Y. Wang, L. Ju, X. Chi, D. Xu, D. Chen, Y. Liu, Z. Liu, **Proceedings of the International Conf. for High Performance Computing, Networking, Storage & Analysis, SC2016**, Article No.4, Salt Lake City, IEEE Press, 2016. (ACM Gordon Bell Prize Finalist).
- *On the variational limit of some nonlocal convex functionals of vector fields*, with T. Mengesha, **Nonlinearity**, 28, 3999-4035, 2015.
- *Asymptotically compatible schemes and applications to robust discretization of nonlocal models*, with X. Tian, **SIAM J. Numer. Anal.**, 52, 1641-1665, 2014.
- *A nonlocal vector calculus, nonlocal volume-constrained problems, and nonlocal balance laws*, with M. Gunzburger, R. Lehoucq and K. Zhou, **Math. Mod. Meth. Appl. Sci.**, 23, 493-540, 2013.
- *Analysis and comparison of different approximations to nonlocal diffusion and linear peridynamic equations*, with X. Tian, **SIAM J. Numer. Anal.**, 51, 3458-3482, 2013 (SIAM Outstanding Paper Prize).
- *Analysis and approximation of nonlocal diffusion problems with volume constraints*, with M. Gunzburger, R. Lehoucq and K. Zhou, **SIAM Review**, 54, 667-696, 2012.
- *Robust Modeling of Constant Mean Curvature Surfaces*, with P. Hao, Y.-K. Choi, Y. Liu, W. Hu, K. Polthier, C. Zhang, W. Wang, **ACM Trans. Graphics (SIGGRAPH12)**, 31, Article 85, 2012.
- *Shrinking Dimer Dynamics and its Applications to Saddle Point Search*, with J.Y. Zhang, **SIAM J. Numer. Anal.**, 50, 1899-1921, 2012.
- *Analysis of a stochastic implicit interface model for an immersed elastic surface in a fluctuating fluid*, with M. Li, **Archive for Rational Mech. Anal.**, 199, 329-352, 2011.
- *Vortex solutions of the high- κ high-field Ginzburg-Landau model with an applied current*, with J. Wei and C. Zhao, **SIAM J. Math. Anal.**, 42, 2368-2401, 2010.
- *Numerical approximations of a norm preserving gradient flow and applications to an optimal partition problem*, with F.-H. Lin, **Nonlinearity**, 22, 67-83, 2009.

- *Modelling and simulations of multi-component lipid membranes and open membranes via diffuse interface approaches*, with X. Wang, **J. Mathematical Biology**, 56, 347-371, 2008
- *Adhesion of vesicles on patterned substrates*, with S. Das, **Phy. Rev. E**, 77.011907 (1-7), 2008 (selected for the Jan 15, 2008 issue of Virtual J. Biological Phys. Res. by APS).
- *Diffuse-interface description of strain-dominated morphology of critical nuclei in phase transformations*, with L. Zhang and L.Q. Chen, **Acta Materialia**, 56, 3568-3576, 2008.
- *Morphology of critical nuclei in solid state phase transformations*, with L. Zhang and L. Chen, **Physical Review Letters**, 98, No.25, 265703, 2007.
- *From micro to macro dynamics via a new closure approximation to the FENE model of polymeric fluids*, with C. Liu and P. Yu, **Multiscale Modeling and Simulations**, 3, 895-917, 2005.
- *Computing the ground state of the Bose-Einstein condensate via normalized gradient flow*, with W. Bao, **SIAM J. Scientific Comp.**, 25, 1674-1697, 2004.
- *A phase field approach in the numerical study of the elastic bending energy for vesicle membranes*, with C. Liu and X. Wang, **J. Computational Physics**, 198, 450-468, 2004.
- *Dissipative flow and vortex shedding in the Painlevé boundary layer of a Bose Einstein condensate*, with A. Aftalion and Y. Pomeau, **Physical Review Letters**, 91, 090407, 2003.
- *Tetrahedral mesh generation and optimization based on centroidal Voronoi tessellations*, with D. Wang, **Int. J. Numer. Meth. Eng.**, 56, 1355-1373, 2003.
- *Vortices in the Bose-Einstein condensate: the critical velocities and energy diagrams in the Thomas-Fermi regime*, with A. Aftalion, **Physical Review A**, 64, 063603(1-11), 2001.
- *Centroidal voronoi diagrams and its applications*, with V. Faber and M. Gunzburger, **SIAM Review**, 41, 637-676, 1999.
- *Ginzburg-Landau vortices: dynamics, pinning and hysteresis*, with F.H. Lin, **SIAM J. Math. Anal.**, 28, 1265-1293, 1997.
- *High-kappa limit of the time dependent Ginzburg-Landau model for superconductivity*, with P. Gray, **SIAM J. Appl. Math.**, 56, 1060-1093, 1996.
- *Spectral viscosity methods for multidimensional hyperbolic conservation laws*, with G. Chen and E. Tadmor, **Mathematics of Computation**, 61, 619-643, 1993.
- *Analysis and approximation of the Ginzburg-Landau model of superconductivity*, with M. Gunzburger and J. Peterson, **SIAM Review**, 34, 54-81, 1992.
- *Numerical studies of a continuum model of Phase Transition*, with R. A. Nicolaides, **SIAM J. Numer. Anal.**, Vol.28, No.5, 1310-1322, 1991;
- *A finite difference domain decomposition algorithm for numerical solution of the heat equation*, with C. Dawson, & T. Dupont, **Mathematics of Computation**, 57, 63-71, 1991;

Selected Refereed Conference Proceedings:

- *Stabilizing traffic via autonomous vehicles: a continuum mean field game approach*, with K. Huang, X. Di, X. Chen, IEEE 22nd Intelligent Transportation Systems Conference (**ITSC**), 3269-3274, 2019.
- *An invitation to nonlocal modeling, analysis and computation*, **ICM2018**, Proceedings of International Congress of Mathematicians, Vol. 3, 3523-3552, Rio de Janeiro, Brazil, 2018.
- *Nonlocal neural networks, nonlocal diffusion and nonlocal modeling*, with Y. Tao, Q. Sun, W. Liu, *Advances in Neural Information Processing Systems* 31 (**NIPS2018**), 494-504, 2018.
- *Extreme-scale phase field simulations of coarsening dynamics on the sunway taihulight supercomputer*, with J. Zhang, C. Zhou, Y. Wang, L. Ju, X. Chi, D. Xu, D. Chen, Y. Liu, Z. Liu, Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis, **SC2016**, Article No.4, Salt Lake City, IEEE Press, 2016. (ACM Gordon Bell Prize Finalist).
- *Intelligent and informative scientific computation, trends and examples*, in *Third International Congress of Chinese Mathematicians, Studies in Advanced Mathematics*, AMS/IP, Vol 42.2, 731-748, 2008