

BIOGRAPHICAL SKETCH: **QIANG DU**

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(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) Appointments

- 2014 - present **Fu Foundation Professor of Applied Mathematics**, Columbia University, and Chair of Applied Mathematics Program Committee (2015-), Fu Foundation School of Engineering and Applied Science, Columbia University
 2014 - present **Affiliated Faculty**, Data Science Institute, and Co-Chair of Center for Foundation of Data Science (2018 -), Columbia University
 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

(c) Visiting and Adjunct Positions

- 2017-2020 Oversea Assessment Expert, Chinese Academy of Sciences.
 2015-2017 Adjunct Professor, Department of Mathematics, Penn State University
 2014-present Adjunct Professor, School of Mathematics, Peking University, China
 Fall 2012 Long term visitor, Institute of Pure and Applied Mathematics (IPAM), UCLA
 2011-2018 Visiting Professor, Beijing Computational Science Research Center
 Fall 2011 Visiting Professor, Beijing International Center for Mathematical Research, and Mt. Everest Program for Gifted Students, School of Mathematics, Peking University
 2007-2013 Member, NSF-IUCRC (PennState-GaTech) CCMD, Penn State University
 Fall 2006 Senior Fellow, IPAM, UCLA
 2005 - 2010 Oversea Outstanding Scholar (program by Chinese Bureau of Foreign Experts and Chinese Ministry of Education) and Jingshi Scholar, Beijing Normal University
 2004-2006 Member, Center for Machine Learning and Applications, Penn State University
 Fall 2004 Long term visitor and tutorial lecturer, special program in material sciences, IMA, UMN
 2002-present Member, MRI (Materials Research Institute), Penn State University
 2002-present Adjunct Professor, Hong Kong University of Science and Technology
 1999 - 2002 Adjunct Professor, University of Science and Technology of China
 1998 - 2004 Chief Scientist, Large Scale Scientific Computation, a national key basic research project, Lab for Scientific and Engineering Computing, Chinese Academy of Sciences
 Spring 1993 Visiting Associate Professor, Dept. of Math. Sciences and Center of Nonlinear Studies, Carnegie Mellon University
 Summer 1989 Faculty Research Participation, Mathematics & Computer Science Division, Argonne National Laboratory, Chicago, Illinois
 Summer 1988 Staff Research Assistant, Computing & Communication Division, Los Alamos National Laboratory, Los Alamos, New Mexico
 1983 - 1984 Training for **inaugural S. S. Chern program** for top Chinese undergraduates to pursue graduate study in the US, through a nation-wide selection by an **AMS-SIAM committee** (the very first personal encounter with the American Mathematics Society)

(d) Research Interests: applied and computational mathematics

- Numerical algorithms and scientific computation: numerical & applied analysis of PDEs; multiscale, nonlocal & stochastic models; scalability & adaptivity
- Continuum mathematical models & applications in physical, biological & materials sciences: superfluids, vortices, complex fluids, membranes, nonlocal mechanics, phase transformations, rare events
- Discrete and geometric models and applications in information sciences: data mining, model reduction, meshing, tessellations, image analysis, and deep learning

(e) Honors and Awards:

- 2018 **Invited lecturer at the ICM2018** (International Congress of Mathematicians);
- 2017 **AAAS Fellow**, for distinguished contributions to the field of applied and computational mathematics, particularly for theoretical analysis and numerical simulations of mathematical models in various applications;
- 2017 **Distinguished speaker for the principal lectures** of NSF-CBMS regional research conference on Nonlocal Dynamics - Theory, Computation and Applications;
- 2017 Inaugural **Scientia Sinica Mathematica prize for excellent paper** published in Chinese;
- 2016 **SIAM outstanding paper prize**, for a paper published in SIAM Journal in Numerical Analysis, (co-authored with Ph.D student Xiaochuan Tian, 2013);
- 2016 **ACM Gordon-Bell prize finalist**; for largest and fastest 3D phase field simulations of microstructure coarsening dynamics (collaborative work with former postdoc Dr. Jian Zhang, lead author of the publication, and other team members);
- 2013 **SIAM Fellow**, for contributions to applied and computational mathematics with applications in materials science, computational geometry, and biology;
- 2008 **Outstanding research team award** for the 10th anniversary of 973 project *Large Scale Scientific Computation Research* (as the team's Chief Scientist), China Ministry of Science and Technology;
- 2007 Recipient of the **Eberly College of Science Medal**, Penn State University;
- 2005 Recipient of the **Feng Kang Prize in Scientific Computing**;
- 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.

(f) Service:

- Editorial boards of journals and book series:
 - Associate Editor (2016–), MATHEMATICS OF COMPUTATION (**American Mathematics Society**);
 - Section Editor (2015–), SIAM JOURNAL OF APPLIED MATHEMATICS;
 - Associate Editor (2003–2012, 2014–), SIAM JOURNAL OF NUMERICAL ANALYSIS;
 - Associate Editor (2012–), SIAM JOURNAL OF APPLIED MATHEMATICS;
 - Member of editorial board (2016–), JOURNAL OF SCIENTIFIC COMPUTING (Springer);
 - Associate Editor (2018–), MATHEMATICAL MODELS & METHODS IN APPLIED SCIENCES;
 - Associate Editor (2000–2005, 2018–), JOURNAL OF COMPUTATIONAL MATHEMATICS;
 - Member of editorial board (2001–2005), COMMUNICATIONS IN PURE AND APPLIED ANALYSIS;
 - Member of editorial board (2002–2007), CHINESE JOURNAL OF COMPUTATIONAL PHYSICS;
 - Editor (2002–2016), APPLIED MATHEMATICS RESEARCH EXPRESS;
 - Member of editorial board (2006–), DISCRETE AND CONTINUOUS DYNAMICAL SYSTEMS - B;
 - Member of editorial board (2004–2007), JOURNAL OF INFORMATION AND COMPUTATIONAL SCIENCE;
 - Associate editor (2009–), NUMERICAL MATHEMATICS: THEORY, METHODS AND APPLICATIONS;
 - Member of editorial board (2009–), JOURNAL OF MATHEMATICAL RESEARCH AND APPLICATIONS;
 - Associate editor (2010–), COMMUNICATIONS IN COMPUTATIONAL PHYSICS;
 - Associate editor (2017–), INTERFACES AND FREE BOUNDARIES, (EMS);
 - Associate editor (2018–), JOURNAL OF PERIDYNAMICS AND NONLOCAL MODELING, Springer;
 - Member of editorial board (2018–), COMMUNICATION ON APPLIED MATHEMATICS AND COMPUTATION;
 - Member of editorial board (2012–), COMMUNICATIONS IN MATHEMATICS AND STATISTICS;
 - Member of editorial board (2013–), JOURNAL OF MATHEMATICAL STUDY;
 - Member of editorial board (2014–), COMMUNICATIONS IN MATHEMATICAL SCIENCES;
 - Editor of book series (2015–), HANDBOOK OF NUMERICAL ANALYSIS, (Elsevier).

- A partial list of other external professional services:

Member (2019), Scientific Program Committee, ICIAM.

Member (2019-2021), SIAM Fellows Canvassing Committee.

Member (2019-2021), SIAM John Von Neumann Lecture Committee.

Member (2018), Scientific Committee of USNCTAM 2018 (joint meeting with Chinese TAM, Chicago).

Co-Chair in Computational Mathematics (2018), World Congress of Computational Mechanics (WCCM).

Member (2017-2018), Physical and Computational Sciences Directorate Advisory Committee,
Pacific Northwest National Laboratory (PNNL).

Member (2017), Visiting Committee for Academic Review of Mathematics Department,
Chinese University of Hong Kong.

Oversea Assessment Expert (2017-2020), Chinese Academy of Sciences.

Conference Co-Chair (2016), SIAM Conference on Mathematical Aspects of Materials Science.

SIAM representative (2015-2019) to the US National Committee -Theoretical and Applied Mechanics
Research (USNC-TAM), the National Academies.

Member (2015-2018), Scientific Advisory Board, Institute for Computational and Experimental
Research in Mathematics (ICERM).

Member (2014), NSF Mathematics Institute Site-Visit Team, Institute of Pure and Applied Mathematics.

Chair (2014-2016), SIAM Activity Group on Mathematical Aspects of Materials Science.

Chair (2014-2015), SIAM Peter Henrici Prize Selection Committee.

Member (2014-present), 9th Council, Chinese Computational Mathematics Society (CCMS).

Panelist (2009), Mathematics panel, Portugal Foundation of Science and Technology ;

Standing Committee member (1998-2002), 5th Council, (CCMS).

Panelist for U.S. National Science Foundation (1997, 2003, 2005-2011, 2013-2016), including Graduate
Fellowship, Career Award, CBMS, Research Training and Focused Research programs.

Panelist for the Department of Energy research grants (2011, 2012, 2013).

Reviewer of research grants for Israel Science Foundation, Portugal Science Foundation, Chinese National
Science Foundation, Ministry of Science and Technology of China, Hong Kong Research Grant Council,
Singapore Ministry of Education, Austrian Research Foundation, KAUST foundation, Natural Sciences
and Engineering Research Council of Canada, Natural Science Council of Taiwan, American Chemical
Society Petroleum Research Fund, European Union Research Organization for Young Investigators, etc.

- University services:

- As Chair of Applied Mathematics Program at Columbia: promoting the interaction with mathematics, statistics, computer science and applications; giving colloquium at the Department of Mathematics; co-organizing the school-wide Distinguished Applied Mathematics Colloquium with other Columbia mathematicians such as Karazkas, Okounkov and Weinstein.

- As co-Chair of Center for Foundation of Data Science in the Data Science Institute at Columbia: promoting mathematics in connection with data analytics and machine learning as well as application of data analytics and machine learning techniques to physics-based modeling.

(g) Research grants:

- Individual research grants from NSF-DMS computational mathematics program for many years;

- Brought support to mathematical sciences, particularly from other disciplines outside mathematics, through collaborative efforts; some examples include NSF-CISE (data science, such as TRIPODS), NSF-DMR (materials science, such as ITR and DMREF), NIH (bioengineering), DOE (BES, environmental and climate science), AFOSR (such as MURI, jointly with physicists and engineers, co-funding from mechanics, mathematics and materials science), NSF-IUCRC (Industry-University Cooperative Research Center, with industry memberships from GE, Boeing, Ford, etc).

- At HKUST, successfully led China's national key project on Large Scale Scientific Computation Research, the largest ever national project at the time (1998) with participation from more than 100 researchers and their students and associates (including almost all leading computational mathematicians in China), which won the outstanding research team award for 973 projects funded by the state funding agency and made lasting impact on computational mathematics development in China.

(h) Training, Mentoring and Teaching:

- 19 former & 4 current Ph.D students in mathematics, some winning NSF graduate fellowship, NSF Career grant, Outstanding alumni award, AWM Best Ph.D dissertation award, SIAM outstanding paper prize, etc;
- Supervised 15 post-doc scholars, including members of under-represented groups, with 10 becoming faculty members/research scientists;
- Supervised 9 M.S. students, participated in NSF funded research for high school teachers, & mentored high school students (some published journal research papers & became math majors at Harvard & Yale, etc);
- Taught many mathematics courses in various institutions; received Frame faculty teaching award.

(i) Invited Lectures:

- Over 440 invited lectures given at conferences/workshops and academic institutions, such as invited 45min lecture at the **International Congress of Mathematicians** (ICM2018, sections 15&17) & distinguished speaker of Householder lecture series at ORNL (2015), IAS-HKUST distinguished lecture series (2016), etc.
- Tutorial lectures at IMA, IMS, BCAM, BICMR, etc. NSF-CBMS distinguished speaker (10 lectures, 2017).

(j) Publications:

- Over 270 refereed publications (230+ in professional journals, 30+ in conference proceedings and 5 book-chapters. 1 research monograph, 1 edited book and 3 edited special journal issues). Over 13000 Google Scholar citations with an H-index 60 and 6900 SCI citations with an H-index 40. MR Author ID 191080 on mathscinet with 216 publications and over 4000 citations by more than 2400 authors.
- Selected publications (full list of publications at www.columbia.edu/~qd2125):
 - *Nonlocal Modeling, Analysis and Computation*, CBMS-NSF Regional Research Conference Series, Vol 94, SIAM, 2019.
 - *Asymptotically compatible SPH-like particle discretizations of one dimensional linear advection models*, with H. Lee, **SIAM J. Numerical Analysis**, 57, 127-147, 2019.
 - *An invitation to nonlocal modeling, analysis and computation*, **Proc. of the International Congress of Mathematicians (ICM 2018)**, 3, 35233552, 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.
 - *Nonlocal conservation laws. I. A new class of monotonicity-preserving models*, with Z. Huang and P. LeFloch, **SIAM J. Numer. Analysis**, 55, 2465-2489, 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, **Proc. International Conference for High Performance Computing, Networking, Storage & Analysis (SC2016)**, Article No.4, IEEE, 2016. (ACM Gordon Bell Prize Finalist).
 - *A class of high order nonlocal operators*, with X. Tian, **Archive of Rational Mechanics and Analysis**, 222, 1521-1553, 2016.
 - *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.
 - *Linear finite element superconvergence on simplicial meshes*, with J. Chen and D. Wang, **Mathematics of Computation**, 83, 2161-2185, 2014.
 - *The bond-based peridynamic system with Dirichlet-type volume constraint*, with T. Mengesha, **Proc. of Royal Soc. Edinburgh, A**, 144, 161-186, 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).
- *A posteriori error analysis of finite element method for linear nonlocal diffusion and peridynamic models*, with L. Ju, L. Tian and K. Zhou, **Mathematics of Computation**, 82, 1889-1922, 2013.
- *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.
- *Motion of interfaces governed by the Cahn-Hilliard equation with highly disparate diffusion mobility*, with S. Dai, **SIAM J. Appl. Math.**, 72, 1818-1841, 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.
- *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.
- *The Quasi-Laguerre iteration*, with M. Jin, T-Y Li and Z. Zeng; **Mathematics of Computation**, 66, 345-361, 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.