

Yao Yao

CONTACT INFORMATION	Department of Mathematics National University of Singapore Block S17, 10 Lower Kent Ridge Road Singapore 119076 <i>Email:</i> yaoyao@nus.edu.sg <i>Homepage:</i> https://blog.nus.edu.sg/yyao/
RESEARCH INTERESTS	Nonlinear partial differential equations and their applications in fluid dynamics and mathematical biology.
WORK EXPERIENCE	Aug 2021 – current: Associate Professor, Department of Mathematics, National University of Singapore Jul 2023 – current: Vice Dean of NUS Graduate School, National University of Singapore Aug 2015 – Jul 2021: Assistant Professor, School of Mathematics, Georgia Institute of Technology Aug 2012 – Jul 2015: Van Vleck Visiting Assistant Professor, University of Wisconsin, Madison
EDUCATION	Aug 2007 - Jun 2012: University of California, Los Angeles, USA <ul style="list-style-type: none">• Ph.D., Mathematics, June 2012. Dissertation Topic: “Aggregation Equation with Degenerate Diffusion” Advisor: Professor Inwon C. Kim• M.A., Mathematics, June 2008. Sep 2003 - Jul 2007: Peking University, Beijing, China <ul style="list-style-type: none">• B.S., Mathematics, July 2007.
PUBLICATIONS	I. Jeong, J. Kim and Y. Yao, On well-posedness of α -SQG equations in the half-plane, preprint, arXiv:2305.04300, 2023. Z. Hu, A. Kiselev and Y. Yao, Suppression of chemotactic singularity by buoyancy, preprint, arXiv:2305.01036, 2023. A. Kiselev, J. Park and Y. Yao, Small scale formation for the 2D Boussinesq equation, preprint, arXiv:2211.05070, 2022. J. Carrillo, D. Gómez-Castro, Y. Yao and C. Zeng, Asymptotic simplification of Aggregation-Diffusion equations towards the heat kernel, to appear in <i>Arch. Ration Mech. Anal.</i> , arXiv:2105.13323, 2021. G. Li and Y. Yao, Two-species competition model with chemotaxis: well-posedness, stability and dynamics, <i>Nonlinearity</i> , 35(3) 1329, 2022. A. Kiselev and Y. Yao, Small scale formations in the incompressible porous media equation, to appear in <i>Arch. Ration Mech. Anal.</i> , arXiv:2102.05213, 2021.

- J. Gómez-Serrano, J. Park, J. Shi and Y. Yao, Remarks on stationary and uniformly-rotating vortex sheets: Flexibility results, *Phil. Trans. R. Soc. A.*, 380, no. 2226, 20210045, 2022.
- J. Gómez-Serrano, J. Park, J. Shi and Y. Yao, Remarks on stationary and uniformly-rotating vortex sheets: Rigidity results, *Comm. Math. Phys.*, 386, 1845–1879, 2021.
- X. Yan and Y. Yao, Sharp stability for the interaction energy, *Arch. Ration Mech. Anal.* 246 (2), 603–629, 2022.
- A. Kiselev, F. Nazarov, L. Ryzhik and Y. Yao, Chemotaxis and reactions in biology, to appear in *J. Eur. Math. Soc.*, arXiv:2004.06441, 2020.
- Y. Y. Li, X. Yan and Y. Yao, Symmetry of hypersurfaces with ordered mean curvature in one direction, *Calc. Var. PDE.*, 60, 173, 2021.
- M. Delgadino, X. Yan and Y. Yao, Uniqueness and nonuniqueness of steady states of aggregation-diffusion equations, *Comm. Pure Appl. Math.*, 75, 3–59, 2022.
- J. Gómez-Serrano, J. Park, J. Shi and Y. Yao, Symmetry in stationary and uniformly-rotating solutions of active scalar equations, *Duke Math. J.*, 170, 2957–3038, 2021.
- J. Carrillo, K. Craig and Y. Yao, Aggregation-diffusion equations: dynamics, asymptotics, and singular limits, *Active Particles*, Volume 2, 65–108, Birkhäuser Basel, 2019.
- J. Carrillo, S. Hittmeir, B. Volzone and Y. Yao, Nonlinear aggregation-diffusion equations: radial symmetry and long time asymptotics, *Invent. Math.*, 218: 889–977, 2019.
- K. Craig, I. Kim and Y. Yao, Congested aggregation via Newtonian interaction, *Arch. Ration Mech. Anal.*, 227(1): 1–67, 2018.
- A. Kiselev, L. Ryzhik, Y. Yao and A. Zlatoš, Finite time singularity for the modified SQG patch equation, *Ann. of Math.*, 184(3), 909–948, 2016.
- A. Kiselev, Y. Yao and A. Zlatoš, Local regularity for the modified SQG patch equation, *Comm. Pure Appl. Math.*, 70(7), 1253–1315, 2017.
- K. Choi, T. Hou, A. Kiselev, G. Luo, V. Sverak and Y. Yao, On the finite-time blowup of a 1D model for the 3D axisymmetric Euler equations, *Comm. Pure Appl. Math.*, 70(11): 2218–2243, 2017.
- Y. Yao and A. Zlatoš, Mixing and un-mixing by incompressible flows, *J. Eur. Math. Soc.*, 19(7), 1911–1948, 2017.
- R. Chinomona, J. Lajeunesse, W. Mitchell, Y. Yao and S. Spagnolie, Dynamics and stability of magnetocapillary swimmers, *Soft Matter*, 11: 1828–1838, 2015.
- K. Choi, A. Kiselev and Y. Yao, Finite time blow up for a 1D model of 2D Boussinesq system, *Comm. Math. Phys.*, 334: 1667 – 1679, 2015.

- D. Alexander, I. Kim and Y. Yao, Quasi-static evolution and congested crowd transport, *Nonlinearity*, 27: 1-36, 2014.
- D. Balagué, J. A. Carrillo and Y. Yao, Confinement for Repulsive-Attractive Kernels, *Discret. Contin. Dyn. S. B*, 19: 1227-1248, 2014.
- Y. Yao, Asymptotic behavior of radial solutions for critical Patlak-Keller-Segel model and an repulsive-attractive aggregation equation, *Ann. Inst. H. Poincaré Anal. Non Linéaire*, 31(1): 81-101, 2014.
- Y. Yao and A. L. Bertozzi, Blow-up profile for the aggregation equation with degenerate diffusion, *Physica D, special issue on Emergent behaviour in multi-particle systems with non-local interactions*, 260: 77-89, 2013.
- L. Chayes, I. C. Kim and Y. Yao, An aggregation equation with degenerate diffusion in periodic domain: qualitative property of solutions, *SIAM J. Math. Anal.*, 45(5): 2597-3049, 2013.
- I. C. Kim and Y. Yao, The Patlak-Keller-Segel model and its variations: properties of solutions via maximum principle, *SIAM J. Math. Anal.*, 44(2): 568-602, 2012.

GRANTS AND AWARDS

- Asian Young Scientist Fellowship, 2023-2025.
- Dean's chair, National University of Singapore, 2021-2024.
- Sloan Research Fellowship, 2020-2021.
- NSF CAREER Grant DMS-1846745, 2019–2021.
- NSF Grant DMS-1715418, 2017–2020.
- University Housing Honored Instructor, UW-Madison, Fall 2014, Spring 2015.
- NSF Grant DMS-1411857, 2014–2017.
- AWM-NSF travel grant, 2013.
- AMS-Simons travel grant, 2013–2014.
- Horn-Moez prize for excellence in first year graduate studies, UCLA, 2008.

JUNIOR RESEARCHERS MENTORED

PhD students:

- Jaemin Park, 2016–2021. (Current position: postdoc at University of Basel)
- Guanlin Li (joint with Joshua Weitz), 2017–2021. (Position after graduation: Financial industry in Chicago.)
- Minling Li (CSC visiting student from Sun Yat-Sen University, joint with Zheng-An Yao), 2022-2024.
- Tao Zhou, 2022–current.

Postdoc researchers:

- Xukai Yan (joint with Ronghua Pan), 2017–2020. (Current position: tenure-track assistant professor at Oklahoma State University)
- Junyan Zhang, 2022–current.

INVITED TALKS

- Workshop on “Partial Differential Equations in Fluid Dynamics”, IASM-BIRS, Hangzhou, China, Aug 2023

- Peking University Math Forum, Beijing, China, Aug 2023
- Workshop on “New Trends in Fluids and Collective Dynamics”, BIRS, Banff, Canada, Jul 2023
- Summer school “Deterministic and random features of fluids”, EPFL, Switzerland, Jul 2023
- Online Seminar on Chemotaxis (online), Jun 2023
- BIRS-IMAG workshop “Nonlinear Diffusion and nonlocal Interaction Models - Entropies, Complexity, and Multi-Scale Structures”, Granada, Spain, May 2023
- Conference on “Recent Advances in Mathematical Fluid Dynamics”, Duke University, USA, May 2023
- Inaugural meeting of Asian-Oceanian Women in Mathematics (online), Apr 2023
- Colloquium, Chinese University of Hong Kong (online), Mar 2023
- 16th EASIAM Conference (online), Oct 2022
- PDE seminar, Peking University (online), Oct 2022
- PDE seminar via Zoom, Chinese Academy of Sciences (online), Oct 2022
- Workshop on “Frontiers in Nonlocal Nonlinear PDEs”, Anacapri, Italy, Jul 2022.
- HYP2022: XVIII International Conferences on Hyperbolic Problems, Málaga, Spain, Jun 2022.
- Applied Math Seminar, Stanford University (online), May 2022.
- Workshop on Recent developments in incompressible fluid dynamics, IAS (online), Apr 2022.
- Oneworld PDE seminar (online), Mar 2022.
- SIAM Conference on Analysis of Partial Differential Equations (online), Mar 2022.
- SIAM Seminar In the Analysis and Methods of PDE (online), Dec 2021.
- Workshop on “Mean Field Limits for Interacting Agents conference”, Institute for Mathematical and Statistical Innovation (online), Nov 2021.
- PDE seminar, Hong Kong University of Science and Technology (online), Sep 2021.
- Workshop on “Numerics, Modeling, and Experiments in Wave Phenomena”, ICERM (online), Sep 2021.
- Workshop on “New Trends in Nonlinear Diffusion: a Bridge between PDEs, Analysis and Geometry”, BIRS-CMO (online), Sep 2021.
- Workshop on “New Mechanisms for Regularity, Singularity, and Long Time Dynamics in Fluid Equations”, BIRS (online), Jul 2021.
- AMS western sectional meeting (online), May 2021.
- Workshop on “Criticality and stochasticity in quasilinear fluid systems” (online), AIM, Apr 2021.
- Applied Math seminar (online), University of South Carolina, Apr 2021.

- Colloquium (online), Georgia Tech, Apr 2021.
- PDE seminar (online), Ohio State University, Mar 2021.
- PDE seminar (online), University of Tennessee, Knoxville, Mar 2021.
- Virtual Analysis and PDE Seminar (online), Feb 2021.
- PDE seminar (online), University of Oxford, Feb 2021.
- Colloquium (online), NYU Abu Dhabi, Jan 2021.
- Connections Workshop: Mathematical problems in fluid dynamics (online), MSRI, Jan 2021.
- Workshop on “Transport and Mixing in Complex and Turbulent Flows” (online), IPAM, Jan 2021.
- Webinar on Gradient Flows in PDEs (online), Institut Camille Jordan, Dec 2020.
- Colloquium (online), Duke Kunshan University, Nov 2020.
- Caltech/UCLA joint analysis seminar (online), Oct 2020.
- APDE seminar (online), Imperial College London, Oct 2020.
- Analysis seminar (online), Georgia Tech, Oct 2020.
- AMS eastern sectional meeting (online), Penn State University, Oct 2020.
- Nonlinear analysis seminar (online), Rutgers University, Sep 2020.
- PDE seminar via Zoom (online), Jul 2020.
- The second joint SIAM/CAIMS annual meeting (online), Jul 2020.
- Young mathematician lecture series (online), National University of Singapore, Jul 2020.
- Online seminar, Beijing International Center for Mathematical Research, Peking University, Apr 2020.
- Analysis Seminar (online), Princeton University, Mar 2020.
- Analysis Seminar, Indiana University, Bloomington, Feb 2020.
- Applied Math Colloquium, Brown University, Feb 2020.
- Workshop on “Emergent Phenomena – from Kinetic Models to Social Hydrodynamics”, Institute for Mathematical Sciences, National University of Singapore, Dec 2019.
- Colloquium, Tulane University, Dec 2019.
- Applied math seminar, Michigan State University, Nov 2019.
- AMS southeastern sectional meeting, University of Florida, Nov 2019.
- KI-Net workshop on Formation of small scales in nonlinear PDEs, University of Maryland, Sep 2019.
- Seminar, Shanghai Center for Mathematical Sciences, Shanghai, China, Jul 2019.
- Tianfu International conference on Partial Differential Equations, Chengdu, China, Jun 2019.
- PDE seminar, University of Electronic Science and Technology of China, Chengdu, China, Jun 2019.

- 3-hour lecture series in the Summer School on Fluid Dynamics, ICMAT, Madrid, Spain, Jun 2019.
- PDE seminar, Sun Yat-sen University, Guangzhou, China, Jun 2019.
- PDE seminar, South China Normal University, Guangzhou, China, Jun 2019.
- PDE seminar, Southern University of Science and Technology, Shenzhen, China, May 2019.
- Analysis seminar, University of California San Diego, May 2019.
- CSCAMM seminar, University of Maryland, May 2019.
- Applied Math seminar, Stanford University, May 2019.
- PDE and Geometric Analysis seminar, University of Wisconsin-Madison, Apr 2019.
- Nonlinear Analysis seminar, Rutgers University, Mar 2019.
- Workshop on Reflections on Mathematical Fluid Dynamics, University of Virginia, Mar 2019.
- Workshop on Nonlinear Differential Equations, Dynamical Systems and Applications, Kansas University, Oct 2018.
- PDE Seminar, Sun Yat-sen University, Guangzhou, China, Aug 2018.
- Gave a 5-hour lecture series on growth and singularity in incompressible fluid equations, Chinese Academy of Science, Beijing, Jul 2018.
- Workshop on “PDEs from biology, ecology and life sciences: models and analysis”, Hong Kong Polytechnic University, Jul 2018.
- The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Taipei, Jul 2018.
- Workshop on “Nonlocal differential equations in collective behavior”, AIM, San Jose, CA, Jun 2018.
- Workshop on “Entropies, the geometry of nonlinear flows, and their applications”, BIRS, Banff, Canada, Apr 2018.
- PDE Model and Nonlinear Waves for Fluids and Plasma Workshop, Tsinghua Sanya International Mathematics Forum, China, Dec 2017
- SIAM Conference on Analysis of Partial Differential Equations, Baltimore, Dec 2017
- Colloquium, University of Pennsylvania, Nov 2017
- International Conference on Classical Incompressible Fluids, Shanghai Center for Mathematical Sciences, China, Oct 2017
- Midwest PDE seminar, University of Illinois Chicago, Sep 2017
- Workshop on “Viscosity solution approach to asymptotic problems in front propagation, dynamical system and related topics”, RIMS, University of Kyoto, Japan, Jul 2017
- Workshop on PDEs: Modelling, Analysis and Numerical Simulation, University of Granada, Spain, Jun 2017
- Mini workshop on PDEs and their applications, Sichuan University, Chengdu, China, Jun 2017

- Tianfu International Conference on Partial Differential Equations, Southwestern University of Finance and Economics, Chengdu, China, Jun 2017
- Gave a 6-hour lecture series on growth and singularity in incompressible fluid equations, Peking University, Beijing, China, Jun 2017
- Workshop “Emerging PDE models in socio-economic sciences”, Mathematics Research Centre, University of Warwick, United Kingdom, May 2017.
- AMS central sectional meeting, University of Indiana Bloomington, Apr 2017.
- Geometry and analysis seminar, Rice University, Mar 2017.
- ICERM Workshop “Dynamics of Small Scales in Fluids”, Feb 2017.
- Workshop “Applications of Optimal Transportation in the Natural Sciences”, Oberwolfach, Germany, Jan 2017.
- KI-Net young researchers workshop: Stochastic and deterministic methods in kinetic theory, Duke University, Nov 2016.
- Workshop “transport phenomena in collective dynamics: from micro to social hydrodynamics”, ETH Zurich, Nov 2016.
- Applied math seminar, George Washington University, Oct 2016.
- AMS western sectional meeting, University of Denver, Oct 2016.
- CNA seminar, Carnegie Mellon University, Sep 2016.
- PDE and analysis seminar, University of Pittsburgh, Sep 2016.
- Workshop on Interactions between Partial Differential Equations & Functional Inequalities, Mittag-Leffler Institute, Sweden, Sep 2016.
- Conference on analysis of PDEs of fluid mechanics, Rice University, May 2016.
- Computational and applied mathematics colloquium, Penn State University, Apr 2016.
- Geometry and analysis seminar, Rice University, Mar 2016.
- KI-Net mini workshop on modeling, analysis, computation and application of kinetic equations, Brown University, Feb 2016.
- SIAM conference on analysis of PDE, Scottsdale, AZ, Dec 2015.
- Conference on analysis and computation in kinetic theory, Stanford University, Nov 2015.
- AMS western sectional meeting, California State University Fullerton, Oct 2015.
- Analysis and applied math seminar, Duke University, Oct 2015.
- The 8th international congress on industrial and applied mathematics, Beijing, China, Aug 2015.
- Fluid seminar, Princeton University, Apr 2015.
- AMS central sectional meeting, Michigan State University, Mar 2015.
- AMS eastern sectional meeting, Georgetown University, Mar 2015.
- Colloquium, Michigan State University, Jan 2015.
- Colloquium, Georgia Institute of Technology, Jan 2015.

- Colloquium, University of California - Davis, Jan 2015.
- Colloquium, University of California - San Diego, Jan 2015.
- Colloquium, University of Southern California, Dec 2014.
- Colloquium, University of Wisconsin, Madison, Dec 2014.
- Colloquium, University of Virginia, Dec 2014.
- PDE seminar, University of Minnesota, Dec 2014.
- Midwest PDE Seminar, University of Illinois at Urbana-Champaign, Oct 2014.
- Workshop on turbulent transport and mixing, IPAM, Los Angeles, Oct 2014.
- Workshop on Entropy methods, PDEs, functional inequalities and applications, BIRS, Banff, Jul 2014.
- PDE seminar at University of Illinois at Urbana-Champaign, Feb 2014.
- SIAM conference on analysis of PDE, Lake Buena Vista, FL, Dec 2013.
- 4th Oklahoma PDE workshop, Stillwater, OK, Oct 2013.
- Young researchers workshop: Kinetic and macroscopic models for complex systems, College Park, MD, Oct 2013.
- CNA seminar, Carnegie Mellon University, Oct 2013.
- Midwest PDE Seminar, University of Michigan, Ann Arbor, May 2013.
- Workshop on PDEs in the social and life science, BIRS, Banff, Apr 2013.
- Analysis seminar, University of Wisconsin, Madison, Dec 2012.
- Young researchers workshop: Kinetic description of multiscale phenomena, Madison, WI, Oct 2012.
- Analysis and PDE Seminar, University of California, Los Angeles, May 2012.
- Analysis seminar, University of Wisconsin, Madison, Feb 2012.
- Workshop on emergent behavior in multi-particle systems with non-local interactions, BIRS, Banff, Jan 2012.
- AMS sectional meeting, Los Angeles, CA, Oct 2010.

TEACHING
EXPERIENCE

National University of Singapore, Singapore

Instructor

- MA3220: Ordinary differential equations, AY2022/23 Sem 1.
- MA4221: Partial differential equations, AY2021/22 Sem 2.
- MA4233: Dynamical systems, AY2022/23 Sem 2.
- MA6215: Topics in differential equations, AY2021/22 Sem 1.

School of Mathematics, Georgia Tech, Atlanta, GA USA

Instructor

- Math 6702: Math Methods of Applied Sciences II (Graduate), Spring 2019
- Math 3406: A Second Course on Linear Algebra, Spring 2018, Fall 2020
- Math 2551: Multivariable Calculus, Fall 2017
- Math 6342: Partial Differential Equations II (Graduate), Spring 2017
- Math 6341: Partial Differential Equations I (Graduate), Fall 2016
- Math 2552: Differential equations, Spring 2016, Fall 2018, Fall 2019

- Math 2551: Multivariable calculus, Fall 2017
- Math 1551: Differential calculus, Fall 2015

Department of Mathematics, UW-Madison, Madison, WI USA

Instructor

- Math 221: First semester calculus, Fall 2014
- Math 222: Second semester calculus, Spring 2015
- Math 276: Topics in Calculus II, Spring 2013
- Math 319: Techniques in Ordinary Differential Equations, Fall 2012
- Math 461: College Geometry I, Fall 2013 - Spring 2015

UCLA Math Boot Camp 2011, Los Angeles, CA USA

Workshop Instructor

Summer 2011

- Responsible for developing and running weekly workshops with the intent of preparing students for the GRE math subject exam.
- Developed worksheets for all subject areas covered in exam.

UCLA Department of Mathematics, Los Angeles, CA USA

Teaching Assistant

- Math 266B (Graduate): Applied Partial Differential Equations, Winter 2010
- Math 266A (Graduate): Applied Ordinary Differential Equations, Fall 2009
- Math 171: Stochastic Processes, Spring 2009-2011
- Math 146: Method of Applied Math, Spring 2012
- Math 142: Mathematical Modeling, Spring 2008 and Fall 2011
- Math 31B: Integration and Infinite Series, Winter 2008 and Winter 2011

SERVICE

- Co-organizer of the workshop “EASIAM workshop on Applied and Computational Mathematics” at NUS, Singapore, May 2023.
- Co-organizer of the special session “Recent Advances in Nonlinear Phenomena” at the AIMS conference at Taipei, Jul 2018.
- Co-organizer of the special session “PDE analysis in fluid flows” at the AMS sectional meeting at University of Georgia, Mar 2016.
- Co-organizer of the special session “Analysis of partial differential equations and fluid dynamics” at the AMS sectional meeting at Loyola University, Chicago, Oct 2015.
- Co-organizer of the minisymposium “Nonlocal aggregation-diffusion equations” at the 8th International Congress on Industrial and Applied Mathematics, Beijing, China, Aug 2015.
- REU Mentor, “Chemotaxis equations with advection”, UW-Madison, Summer 2013
- REU Mentor, “Dynamics and stability of magnetocapillary swimmers”, UW-Madison, Summer 2013
- Article referee for Acta Applicandae Mathematicae, Analysis & PDE, Annals of PDE, Annals of Probability, Annales de l’Institut Henri Poincaré Analyse non lineaire, Applied Mathematics Letters, Archive for Rational Mechanics and Analysis, Communications in Mathematical Physics, Communications in Mathematical Sciences, Communications in Partial Differential Equations,

Communications on Pure and Applied Analysis, Communications on Pure and Applied Mathematics, Discrete and Continuous Dynamical Systems - Series A, Duke Mathematical Journal, European Journal of Applied Mathematics, Journal de Mathématiques Pures et Appliquées, Journal of Differential Equations, Journal of the American Mathematical Society, Journal d'Analyse Mathématique, Journal of the European Mathematical Society, Journal of Evolution Equations, Journal of Functional Analysis, Journal of Mathematical Analysis and Applications, Journal of Nonlinear Science, International Mathematics Research Notices, Kinetic and Related Models, Mathematical Models and Methods in Applied Sciences, Mathematische Annalen, Nonlinear Analysis: Real World Applications, Nonlinearity, Research in the Mathematical Sciences, SIAM Journal on Mathematical Analysis, Transactions of the American Mathematical Society.

- Associate Editor of the following journals:
 - *Kinetics and Related Models*, 2022–current.
 - *Nonlinear Analysis*, 2021–current.
 - *Nonlinearity*, 2022–current.
 - *SIAM Journal on Mathematical Analysis*, 2022–current.
- Vice president of EASIAM, 2023–2024.
- NSF panelist, 2018, 2019, 2020.
- Service at Georgia Tech: Graduate Committee (2020–2021), Undergraduate Committee (2019–2021), Faculty Advisory Committee (2017–2019), Election Committee (2016–2018), Colloquium Committee (2016–2017).
- Service at NUS: Colloquium Committee (2022–2023), Faculty Promotion and Tenure Committee (2022–current), Exco committee (2023–current).