Wenrui Hao, Ph.D.

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Employment

Jul. 2022 – present	**Associate professor**, Department of Mathematics, Penn State University, University Park, PA, USA
Aug. 2016 – Jun. 2022	**Assistant professor**, Department of Mathematics, Penn State University, University Park, PA, USA
Aug. 2013 – Aug. 2016	**Postdoc fellow**, Mathematical Biosciences Institute, Ohio State University, Columbus, OH, USA.

Education

Aug. 2013	**Ph.D. in Applied Mathematics**, University of Notre Dame, Notre Dame, IN, USA.
Jun. 2008	**M.S. in Computational Mathematics**, Nankai University, Tianjin, China.
Jun. 2005	**B.S. in Applied Mathematics**, University of Science & Technology Beijing, Beijing, China.

Research Grants

2022-2027	**NIH Maximizing Investigators' Research Award (1R35GM146894)**, A pathophysiology driven spatial dynamic modeling framework for personalized prediction and precision medicine, $ 1,917,995 (Single PI).
2021-2024	**NSF Mathematical Biology (DMS-2052685)**, Personalized modeling of Alzheimer's disease, $ 220,000 (PI at Penn State, a collaborative project with J. Petrella at Duke with a total budget $ 445,000).
2019-2020	**AiCure research grant**, Efficient training algorithms development for action detection & recognition, $ 73,450 (Completed, Single PI).
2018-2021	**NSF Computational Mathematics (DMS-1818769)**, Homotopy methods for computing bifurcations and multiple solutions of nonlinear PDEs with biological applications, $ 128,408 (Completed, Single PI).
2017-2021	**American Heart Association Scientist Development Grant (17SDG33660722)**, Personalized diagnosis and prediction of atherosclerotic aneurysms via computational models, $ 231,000 (Completed, Single PI).
2017-2018	**The Institute for CyberScience Seed Grant Program**, Predicting glucose level using cardiovascular activities through deep learning techniques, $ 25,000 (Completed, PI with X. Gao and J. Xu).

Publications

Journal Articles

1 Lu, M.-J., Hao, W., Hu, B., & Li, S. (2023). Bifurcation analysis of a free boundary model of vascular tumor growth with a necrotic core and chemotaxis. *Journal of Mathematical Biology*, *86*(1), 1–28.

2 Chen, J., Hao, W., Zhang, L. et al. (2022). Predict blood pressure by photoplethysmogram with the fluid-structure interaction modeling. *Communications in Computational Physics*, *31*(4), 1114–1133.

3 Chen, Q., & Hao, W. (2022). Randomized newton's method for solving differential equations based on the neural network discretization. *Journal of Scientific Computing*, *92*(2), 1–22.

4 Chen, Q., Hao, W., & He, J. (2022a). A weight initialization based on the linear product structure for neural networks. *Applied Mathematics and Computation*, *415*, 126722.

5 Chen, Q., Hao, W., & He, J. (2022b). Power series expansion neural network. *Journal of Computational Science*, 101552.

6 Friedman, A., Hao, W., & Lam, K.-Y. (2022). A cancer model with nonlocal free boundary dynamics. *Journal of Mathematical Biology*, *85*(5), 1–28.

7 Hao, W., Lenhart, S., & Petrella, J. (2022). Optimal anti-amyloid-beta therapy for alzheimer's disease via a personalized mathematical model. *PLOS Computational Biology*, *18*(9), e1010481.

8 Hao, W. (2022). An adaptive homotopy tracking algorithm for solving nonlinear parametric systems with applications in nonlinear odes. *Applied Mathematics Letters*, *125*, 107767.

9 Hao, W., & Zheng, C. (2022). Learn bifurcations of nonlinear parametric systems via equation driven neural networks. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, *30*(9), 093113.

10 Huang, Y., Hao, W., & Lin, G. (2022). Hompinns: Homotopy physics-informed neural networks for learning multiple solutions of nonlinear elliptic differential equations. *Computers & Mathematics with Applications*, *121*, 62–73.

11 Lu, M.-J., Hao, W., Liu, C., Lowengrub, J., & Li, S. (2022). Nonlinear simulation of vascular tumor growth with chemotaxis and the control of necrosis. *Journal of Computational Physics*, *459*, 111153.

12 Zhao, X., Chen, L.-Q., Hao, W., & Zhao, Y. (2022). Bifurcation analysis reveals solution structures of phase field models. *Communications on Applied Mathematics and Computation*, 1–26.

13 Zhao, X. E., Hao, W., & Hu, B. (2022). Two neural-network-based methods for solving elliptic obstacle problems. *Chaos, Solitons & Fractals*, *161*, 112313.

14 Zheng, H., Petrella, J. R., Doraiswamy, P. M., Lin, G., & Hao, W. (2022). Data-driven causal model discovery and personalized prediction in alzheimer's disease. *NPJ digital medicine*, *5*(1), 1–12.

15 Hao, W. (2021). A gradient descent method for solving a system of nonlinear equations. *Applied Mathematics Letters*, *112*, 106739.

16 Hao, W., Lam, K.-Y., & Lou, Y. (2021). Ecological and evolutionary dynamics in advective environments: Critical domain size and boundary conditions. *Discrete & Continuous Dynamical Systems-B*, *26*(1), 367.

17 Hao, W., Sun, P., Xu, J., & Zhang, L. (2021). Multiscale and monolithic arbitrary lagrangian–eulerian finite element method for a hemodynamic fluid-structure interaction problem involving aneurysms. *Journal of Computational Physics*, *433*, 110181.

18 Hao, W., & Zheng, C. (2021). A stochastic homotopy tracking algorithm for parametric systems of nonlinear equations. *Journal of Scientific Computing*, *87*(3), 1–14.

19 Ke, G., Hans, C., Agarwal, G., Orion, K., Go, M., & Hao, W. (2021). Mathematical model of atherosclerotic aneurysm. *Mathematical Biosciences and Engineering: MBE*, *18*(2), 1465–1484.

20 Luo, Y., Li, X., & Hao, W. (2021). Projection based model reduction for the immersed boundary method. *International Journal for Numerical Methods in Biomedical Engineering*, 107767.

21 Zhao, X. E., Hao, W., & Hu, B. (2021). Convergence analysis of neural networks for solving a free boundary problem. *Computers & Mathematics with Applications*, *93*, 144–155.

22 Chen, J., Huang, H., Hao, W., & Xu, J. (2020). A machine learning method correlating pulse pressure wave data with pregnancy. *International journal for numerical methods in biomedical engineering*, *36*(1), e3272.

23 Hao, W., Hesthaven, J., Lin, G., & Zheng, B. (2020). A homotopy method with adaptive basis selection for computing multiple solutions of differential equations. *Journal of Scientific Computing*, *82*(1), 1–17.

24 Hao, W., & Xue, C. (2020). Spatial pattern formation in reaction–diffusion models: A computational approach. *Journal of mathematical biology*, *80*(1), 521–543.

25 Hao, W., & Zheng, C. (2020a). An adaptive homotopy method for computing bifurcations of nonlinear parametric systems. *Journal of Scientific Computing*, *82*(3), 1–19.

26 Hao, W., & Zheng, C. (2020b). Bifurcation analysis of a free boundary model of the atherosclerotic plaque formation associated with the cholesterol ratio. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, *30*(9), 093113.

27 Karagiannis, G., Hao, W., & Lin, G. (2020). Calibrations and validations of biological models with an application on the renal fibrosis. *International journal for numerical methods in biomedical engineering*, *36*(5), e3329.

28 Chen, Q., & Hao, W. (2019). A homotopy training algorithm for fully connected neural networks. *Proceedings of the Royal Society A*, *475*(2231), 20190662.

29 Hao, W., Lam, K.-Y., & Lou, Y. (2019). Concentration phenomena in an integro-pde model for evolution of conditional dispersal. *Indiana University mathematics journal*, *68*.

30 Hao, W., & Yang, Y. (2019). Convergence of a homotopy finite element method for computing steady states of burgers' equation. *ESAIM: Mathematical Modelling and Numerical Analysis*, *53*(5), 1629–1644.

31 Petrella, J. R., Hao, W., Rao, A., & Doraiswamy, P. M. (2019). Computational causal modeling of the dynamic biomarker cascade in alzheimer's disease. *Computational and mathematical methods in medicine*, *2019*.

32 Friedman, A., & Hao, W. (2018). The role of exosomes in pancreatic cancer microenvironment. *Bulletin of mathematical biology*, *80*(5), 1111–1133.

33 Hao, W. (2018). A homotopy method for parameter estimation of nonlinear differential equations with multiple optima. *Journal of Scientific Computing*, *74*(3), 1314–1324.

34 Hao, W., & Harlim, J. (2018). An equation-by-equation method for solving the multidimensional moment constrained maximum entropy problem. *Communications in Applied Mathematics and Computational Science*, *13*(2), 189–214.

35 Hao, W., Hu, B., Li, S., & Song, L. (2018). Convergence of boundary integral method for a free boundary system. *Journal of Computational and Applied Mathematics*, *334*, 128–157.

36 Wang, Y., Hao, W., & Lin, G. (2018). Two-level spectral methods for nonlinear elliptic equations with multiple solutions. *SIAM Journal on Scientific Computing*, *40*(4), B1180–B1205.

37 Brake, D. A., Bates, D. J., Hao, W., Hauenstein, J. D., Sommese, A. J., & Wampler, C. W. (2017). Algorithm 976: Bertini_real: Numerical decomposition of real algebraic curves and surfaces. *ACM Transactions on Mathematical Software (TOMS)*, *44*(1), 1–30.

38 Friedman, A., & Hao, W. (2017). Mathematical modeling of liver fibrosis. *Mathematical Biosciences & Engineering*, *14*(1), 143.

39 Golubitsky, M., Hao, W., Lam, K.-Y., & Lou, Y. (2017). Dimorphism by singularity theory in a model for river ecology. *Bulletin of mathematical biology*, *79*(5), 1051–1069.

40 Hao, W., Gong, S., Wu, S., Xu, J., Go, M. R., Friedman, A., & Zhu, D. (2017). A mathematical model of aortic aneurysm formation. *PloS one*, *12*(2), e0170807.

41 Hao, W., Komar, H. M., Hart, P. A., Conwell, D. L., Lesinski, G. B., & Friedman, A. (2017). Mathematical model of chronic pancreatitis. *Proceedings of the National Academy of Sciences*, *114*(19), 5011–5016.

42 Hao, W., & Friedman, A. (2016). Mathematical model on alzheimer's disease. *BMC systems biology*, *10*(1), 1–18.

43 Hao, W., Schlesinger, L. S., & Friedman, A. (2016). Modeling granulomas in response to infection in the lung. *PLoS One*, *11*(3), e0148738.

44 Friedman, A., & Hao, W. (2015). A mathematical model of atherosclerosis with reverse cholesterol transport and associated risk factors. *Bulletin of mathematical biology*, *77*(5), 758–781.

45 Friedman, A., Hao, W., & Hu, B. (2015). A free boundary problem for steady small plaques in the artery and their stability. *Journal of Differential Equations*, *259*(4), 1227–1255.

46 Gainutdinov, A. M., Hao, W., Nepomechie, R. I., & Sommese, A. J. (2015). Counting solutions of the bethe equations of the quantum group invariant open xxz chain at roots of unity. *Journal of Physics A: Mathematical and Theoretical*, *48*(49), 494003.

47 Hao, W., Marsh, C., & Friedman, A. (2015). A mathematical model of idiopathic pulmonary fibrosis. *PLoS One*, *10*(9), e0135097.

48 Hao, W., Xu, Z., Liu, C., & Lin, G. (2015). A fictitious domain method with a hybrid cell model for simulating motion of cells in fluid flow. *Journal of Computational Physics*, *280*, 345–362.

49 Lindsay, A. E., Hao, W., & Sommese, A. J. (2015). Vibrations of thin plates with small clamped patches. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *471*(2184), 20150474.

50 Sturrock, M., Hao, W., Schwartzbaum, J., & Rempala, G. A. (2015). A mathematical model of pre-diagnostic glioma growth. *Journal of theoretical biology*, *380*, 299–308.

51 Hao, W., Crouser, E. D., & Friedman, A. (2014). Mathematical model of sarcoidosis. *Proceedings of the National Academy of Sciences*, *111*(45), 16065–16070.

52 Hao, W., & Friedman, A. (2014). The ldl-hdl profile determines the risk of atherosclerosis: A mathematical model. *PloS one*, *9*(3), e90497.

53 Hao, W., Hauenstein, J. D., Hu, B., & Sommese, A. J. (2014). A bootstrapping approach for computing multiple solutions of differential equations. *Journal of Computational and Applied Mathematics*, *258*, 181–190.

54 Hao, W., Nepomechie, R. I., & Sommese, A. J. (2014). Singular solutions, repeated roots and completeness for higher-spin chains. *Journal of Statistical Mechanics: Theory and Experiment*, *2014*(3), P03024.

55 Hao, W., Rovin, B. H., & Friedman, A. (2014). Mathematical model of renal interstitial fibrosis. *Proceedings of the National Academy of Sciences*, *111*(39), 14193–14198.

56 Hao, W., Hauenstein, J. D., Hu, B., McCoy, T., & Sommese, A. J. (2013). Computing steady-state solutions for a free boundary problem modeling tumor growth by stokes equation. *Journal of Computational and Applied Mathematics*, *237*(1), 326–334.

57 Hao, W., Hauenstein, J. D., Shu, C.-W., Sommese, A. J., Xu, Z., & Zhang, Y.-T. (2013). A homotopy method based on weno schemes for solving steady state problems of hyperbolic conservation laws. *Journal of Computational Physics*, *250*, 332–346.

58 Hao, W., Hu, B., & Sommese, A. J. (2013). Cell cycle control and bifurcation for a free boundary problem modeling tissue growth. *Journal of Scientific Computing*, *56*(2), 350–365.

59 Hao, W., Nepomechie, R. I., & Sommese, A. J. (2013). Completeness of solutions of bethe's equations. *Physical Review E*, *88*(5), 052113.

60 Hao, W., Sommese, A. J., & Zeng, Z. (2013). Algorithm 931: An algorithm and software for computing multiplicity structures at zeros of nonlinear systems. *ACM Transactions on Mathematical Software (TOMS)*, *40*(1), 1–16.

61 Hao, W., & Zhu, S. (2013). Domain decomposition schemes with high-order accuracy and unconditional stability. *Applied mathematics and computation*, *219*(11), 6170–6181.

62 Hao, W., Hauenstein, J. D., Hu, B., Liu, Y., Sommese, A. J., & Zhang, Y.-T. (2012a). Bifurcation for a free boundary problem modeling the growth of a tumor with a necrotic core. *Nonlinear Analysis: Real World Applications*, *13*(2), 694–709.

63 Hao, W., Hauenstein, J. D., Hu, B., Liu, Y., Sommese, A. J., & Zhang, Y.-T. (2012b). Continuation along bifurcation branches for a tumor model with a necrotic core. *Journal of Scientific Computing*, *53*(2), 395–413.

64 Hao, W., Hauenstein, J. D., Hu, B., Liu, Y., Sommese, A. J., & Zhang, Y.-T. (2011). Multiple stable steady states of a reaction-diffusion model on zebrafish dorsal-ventral patterning. *Discrete and Continuous Dynamical Systems-Series S*, *4*(6), 1413–1428.

65 Hao, W., Hauenstein, J. D., Hu, B., & Sommese, A. J. (2011). A three-dimensional steady-state tumor system. *Applied Mathematics and Computation*, *218*(6), 2661–2669.

Books and Chapters

1 Hao, W., Hu, B., & Sommese, A. J. (2014). Numerical algebraic geometry and differential equations. In *Future vision and trends on shapes, geometry and algebra* (pp. 39–53). Springer.

Advising

Ms. Yutong Mao	Undergraduate student, Penn State University, 2022 Mar. – present. She is supported by the Office of Science Engagement.
Mr. Lee Sun	Ph.D. student, Penn State University, 2022 Jan. – now.
Mr. Zhiyuan Li	Undergraduate student, Penn State University, 2021 May – present. He is supported by the Office of Science Engagement and Schreyer Honors College.
Dr. Yushuang Luo	Ph.D. student, Penn State University, (Co-advise with Prof. Xiantao Li), Graduated in 2022 Aug. First job: software engineer at Facebook.
Dr. Chunyue Zheng	Ph.D. student, Penn State University, Graduated in 2021 Dec. First job: software engineer at Facebook.
Mr. David Bromberg	Undergraduate student, Penn State University, 2020 Sep. – 2021 May. He is in the MBA program at the Wharton school of the University of Pennsylvania.
Dr. Qipin Chen	Ph.D. student, Penn State University, Graduated in 2020 Dec. First job: software engineer at Amazon.
Dr. Chuanbin Li	Postdoc researcher, 2017 Aug.-2019 Dec. First job: software engineer at Google.
Mr. Heming Liu	Undergraduate student, Penn State University, 2019 Summer. He is a graduate student of Department of Statistics at University of Chicago.

Advising (continued)

Ms. Yao Xiao	Undergraduate student, Penn State University, 2017 Summer. She is a graduate student of School of Computer Science at Carnegie Mellon University.
Mr. Yifan Chen	Undergraduate student, Penn State University, 2017 Summer (Supported by the Office of Science Engagement). He is a graduate student of Smeal College of Business at Penn State.
Mr. Arazi Lubis	Undergraduate student, Penn State University, 2017 Summer.
Ms. Adithi Rao	High school student, Penn State University, 2017 Summer.

Invited Presentations

1. Compute multiple solutions of nonlinear differential equations via neural networks. (2023). AMS JMM, Jan.
2. Leveraging computational modeling to understand biomedical diseases. (2023). ACMS Colloquium, University of Notre Dame, Jan.
3. Computational modeling for biomedical diseases. (2022). Department of Mathematics Colloquium, Arizona State University, Oct.
4. Nonlinear scientific computing arising from mathematical biology. (2022). Mathbio Seminar, Arizona State University, Oct.
5. Learn Bifurcation Points Through Neural Networks. (2022). SIAM Conference on Mathematics of Data Science, Sep.
6. Data-driven modeling on Alzheimer's disease. (2022). Colloquium Lecture Series, University of Tennessee at Chattanooga, Jul.
7. Data-driven modeling on Alzheimer's disease. (2022). PDE Seminar, Vanderbilt University, Apr.
8. Numerical methods for computing solution structures of nonlinear PDEs. (2022). Applied Math Seminar, George Washington University, Mar.
9. Computational modeling for biomedical diseases. (2022). Department of Mathematics Colloquium, University of California San Diego, Feb.
10. Data-driven modeling on Alzheimer's disease. (2022). Mathbio Seminar, Ohio State University, Feb.
11. Data-driven modeling on Alzheimer's disease. (2022). ICQMB Center Seminar, University of California Riverside, Feb.
12. Computational models of cardiovascular disease. (2021). The fourth TSIMF conference on Computational and Mathematical Bioinformatics and Biophysics, Dec.
13. Homotopy methods for solving nonlinear PDEs. (2021). University Science and Technology Beijing, Seminar on Applied Math, Oct.
14. Homotopy methods for solving nonlinear systems and beyond. (2021). University of Florida, Seminar on Applied and Numerical Analysis, Sep.
15. Initializing Neural Networks by Algebraic Geometry. (2021). SIAM Conference on Applied Algebraic Geometry, Aug.

16 Homotopy methods for solving nonlinear PDEs. (2021). Xi'an Jiaotong University, Seminar of Numerical PDE and Deep Learning in Industrial Applications, Jul.

17 Computational models of cardiovascular disease. (2021). 2021 SMB annual meeting, Jun.

18 Computational models of cardiovascular disease. (2021). UMass Amherst, Mathematical and Computational Biology Seminar, May.

19 Numerical methods for solving nonlinear PDEs from homotopy methods to machine learning. (2021). University of South Carolina, Applied and Computational Mathematics Seminar, Feb.

20 Numerical methods for solving nonlinear PDEs from homotopy methods to machine learning. (2021). The City College of New York, Mathematics Colloquium, Feb.

21 Homotopy training algorithm for neural networks and applications in pattern formation. (2021). Sanya Workshop on Algebraic Geometry and Machine Learning, Jan.

22 Nonlinear scientific computing in machine learning and applications. (2020). Seminar on Optimization and Data Science, University of California San Diego, November, Nov.

23 A Randomized Newton's Method For Solving Differential Equations Based On The Neural Network Discretization. (2020). 3rd Annual Meeting of the SIAM Texas-Louisiana Sectional Conference, Texas A&M University, Oct.

24 Nonlinear computation in neural networks. (2020). AMS Fall Eastern Sectional Meeting, Penn State, Oct.

25 Nonlinear scientific computing in machine learning and applications. (2020). Department of Mathematics Colloquium, University of Manitoba, Canada, Oct.

26 Numerical methods for solving nonlinear PDEs from homotopy methods to machine learning. (2020). Applied and Computational Mathematics Seminar, Georgia Tech, Oct.

27 A homotopy training algorithm for fully connected neural networks. (2020). Special Session on Algebraic Geometry and Machine Learning, SIAM Conference on Mathematics of Data Science, Jul.

28 Reaction-diffusion equations in biology: from pattern formation to Alzheimer's disease. (2020). Applied Math seminar, Illinois Institute of Technology, Jul.

29 Computational methods for solving nonlinear systems arising from biology. (2020). Mathematical and Computational Methods in Biology, Mathematical Biosciences Institute, May.

30 Computational modeling of cardiovascular disease. (2019). Applied math colloquium, Illinois Institute of Technology, Nov.

31 Computational modeling of cardiovascular disease. (2019). Conference on Computational Mathematics and Applications, Las Vegas, Oct.

32 Homotopy methods for solving nonlinear systems and beyond. (2019). Applied math seminar, University of Alabama, Oct.

33 Homotopy methods for solving nonlinear systems and beyond. (2019). The Third Conference on Scientific and Engineering Computing for Young Chinese Scientists, Aug.

34 Harness computational modeling to biomedical data. (2019). Computational Modeling and Image Processing of Biomedical Problems, Michigan Technological University, Jun.

35 Homotopy methods for nonlinear systems from PDE to machine learning. (2019). Computational math colloquium, Purdue University, Mar.

36 Computational modeling of cardiovascular disease. (2018). Applied math seminar, Michigan State University, Nov.

37 Mathematical Modeling for Chronic Disease Research. (2018). Harnessing Big Data Science for Nutrition and Chronic Disease Discoveries, Penn State Nutrient Department, Nov.

38 Computational modeling of cardiovascular disease. (2018). SIAM Conference on Life Sciences, Minneapolis, Aug.

39 Bifurcations arising from a generalized Hele-Shaw problem. (2018). Numerical Analysis of Coupled and Multi-Physics Problems with Dynamic Interfaces, Oaxaca, Jul.

40 Harness computational modeling to evaluate personalized cardiovascular risk. (2018). American Heart Association public breakfast, Jun.

41 Mathematical modeling of Alzheimer's disease. (2018). NSF-CBMS Regional Conference on Mathematical Biology, Washington DC, May.

42 Reduced Basis Homotopy Method for Computing Multiple Solutions of Nonlinear PDEs. (2017). SIAM Conference on Applied Algebraic Geometry, Atlanta, Georgia, Aug.

43 Computational modeling for cardiovascular disease. (2017). University of Dealware, May.

44 Mathematical modeling for vascular diseases. (2016). IUPUI, Mar.

45 Numerical methods for nonlinear systems and biological applications. (2016). Wright State, Mar.

46 Numerical methods for parameter investigations in nonlinear systems. (2016). Penn State, Mar.

47 Mathematical modeling for vascular diseases. (2016). University of Florida, Feb.

48 Parameter investigations in biological systems. (2016). Hongkong University, Jan.

49 Mathematical modeling for vascular diseases. (2015). Louisiana University, Dec.

50 Mathematical modeling for vascular diseases. (2015). Virginia Tech, Nov.

51 Fictitious Domain Method with a Hybrid Cell Model for Simulating Motion of Cells in Fluid Flow. (2015). ICIAM, Aug.

52 Homotopy continuation methods for nonlinear PDEs and applications. (2015). University of Maryland, College Park, Apr.

53 Homotopy continuation methods for nonlinear PDEs and applications. (2015). Ohio State University, Feb.

54 Fictitious Domain Method with a Hybrid Cell Model for Simulating Motion of Cells in Fluid Flow. (2014). 2014 SIAM Annual Meeting.

55 Parameter investigation and biological systems. (2014). ICERM, Brown University, Jun.

56 Homotopy Method and biological applications. (2014). 2014 AMS JMM.

57 Homotopy Method and Nonlinear PDEs. (2013). UC Irvine applied math. seminar, Sep.

58 Applications of Homotopy Method to Nonlinear PDEs. (2013). SIAM Conference on Applied Algebraic Geometry, Aug.

59 MULTIPLICITY: A software for computing multiplicity structures at zeros of nonlinear systems. (2013). Symbolic Computation Seminar, NC State University, Apr.

60 Numerical methods for nonlinear PDEs with biological applications. (2013). Applied Math Seminar, Colorado State University, Mar.

61 Numerical methods for nonlinear PDEs with biological applications. (2013). Math. Colloquium, Michigan Technological University, Feb.

62 Numerical methods for nonlinear PDEs with biological applications. (2013). Math. Colloquium, Auburn University, Feb.

63 Cell cycle control and bifurcation for a free boundary problem modeling tissue growth. (2012). Numerical Algebraic Geometric Algorithms for Kinematics and PDE Applications, SIAM annual meeting, Jul.

64 Solve nonlinear PDE using numerical algebraic geometry. (2012). Midwest Numerical Analysis Days 2012, Notre Dame, May.

65 A numerical approach to solve tumor growth model with a free boundary. (2012). Illinois Institute of Technology, Feb.

66 Applications of numerical algebraic geometry to tumor growth. (2012). University of Alberta, Feb.

67 A Domain Decomposition Algorithm for Computing Multiple Steady States of Differential Equations. (2011). SIAM Conference on Applied Algebraic Geometry, Oct.

68 Computing steady-state solutions for a free boundary problem modeling tumor growth by stokes equation. (2011). The 2011 CNA fluids conference: Incompressible fluids, Turbulence and Mixing, Oct.

69 Homtopy continuation and tumor growth. (2010). 2010 AMS Fall Central Section Meeting, Nov.

Organized Conferences

1 Special Session on Nonlinear Scientific Computing and Applications. (2020), (AMS 2020 Fall Eastern Sectional Meeting, University Park, PA, Oct.).

2 Special Session on Numerical Methods for PDEs and Applications. (2019), (AMS 2019 Joint Mathematics Meetings, Baltimore, Maryland, Jan.).

3 Special Session on Nonlinear Systems and Applications. (2017), (AMS 2017 Joint Mathematics Meetings, Atlanta, Georgia, Jan.).

4 Special Session on PDE problems with moving and free boundaries. (2017), (2017 (14th) international conference on free boundary problems theory and applications, Shanghai, China, Jul.).

5 Special Session on Nonlinear Systems: polynomial equations, nonlinear PDEs and applications. (2014), (AMS 2014 Joint Mathematics Meetings, Baltimore, Maryland, Jan.).

6 Minisymposium on Applications of Numerical Algebraic Geometry. (2013), (SIAM Conference on Applied Algebraic Geometry, Colorado State University, Aug.).

Teaching Experience

Math 250	**Ordinary differential equation**, Fall 2016
Math 451	**Numerical Computation**, Spring 2017, Fall 2018, Spring 2019, Fall 2020, Spring 2023
Math 455	**Numerical Analysis**, Spring 2020
Math 535	**Linear algebra and applications**, Fall 2021
Math 551	**Numerical ordinary differential equation**, Fall 2017
Math 555	**Numerical optimization**, Fall 2022
Math 597	**Topics in free boundary problems**, Fall 2019
Ohio State	**Calculus for the Biological Sciences**, Autumn 2014
Notre Dame	**Finite Mathematics**, Fall 2011
Notre Dame	**Calculus B**, Summer 2010

Awards

2020 April **Donald C. Rung Award for Distinguished Undergraduate Teaching**, Penn State University.

2022 September **Maximizing Investigators' Research Award**, NIH/NIGMS.

Professional Memberships

SIAM **Society for Industrial and Applied Mathematics**

AHA **American Heart Association**

Professional Service

2017-present **Eberly college of science graduate faculty review committee**

2018-2021 **The Departmental GTA Oversight Committee**

2021-2023 **The Departmental Qualifying Exam Committee**

2021-2022 **Institute for Computational and Data Sciences Coordinating Committee**

2022-present **The Departmental Graduate Studies Committee**

2022-2023 **University Faculty Senate Committee on Research, Scholarship, and Creative Activity**

Editorial Boards

2023-present **Mathematical Biosciences**