

## Curriculum Vitae

### Education

- Ph.D., "Homogenization of thermal-hydro-mass transport process and some perspectives on electrokinetics", Computational Mathematics, University of Science and Technology of China, Advisors Xingye Yue and Chun Liu, (Joint-Supervision in Penn. State University) 2008-2013.

### Professional Experience

- 08/01/2019-Now, Assistant Professor, Duke Kunshan University.
- 08/01/2017-07/30/2019, Postdoc in Fields Institute for Research in Mathematical Sciences, Advisors: Dr. Arvind Gupta and Dr. Huaxiong Huang.
- 07/01/2016-07/02/2017, Postdoc in University of California, Riverside. Advisor: Dr. Mark Alber.
- 07/01/2015-06/30/2016, Postdoc in University of Notre Dame. Advisor: Dr. Mark Alber.
- 07/31/2013- 06/30/2015, Postdoc in National University of Singapore. Advisor: Dr. Weiqing Ren.
- 03/15/2012-05/13/2013, exchange student in Penn. State University. Advisor: Dr. Chun Liu.
- 04/15/2012-08/14/2012, Visitor in University of Wuerzburg. Host: Dr. Anja Schlömerkemper.

### Research Interest

- Machine Learning and Data Driven Model for Cardiopulmonary Disease
- Computational Neuron Science
- Computer DRAM Reliability
- Energetic Variational Approach to Complex Fluid
  - Blood Clot Formation and Deformation
  - Moving Contact Line
  - Fluid Structure Interaction and Cell Motion
  - Electrodynamics and Ion Channels
- Homogenization Theory and Multiscale Modeling

## Research Funds

- National Natural Science Foundation of China (PI), Multiscale Modeling and Application of Ion Transport on Multicellular Tissue, 510,000 RMB, 2021/01-2024/12
- Intelligent model for memory data maintenance and unit isolation (PI), with Huawei Technologies Co., Ltd, 556,700 RMB, 2021/06-2021/12.
- National Key Research and Development Plan funding, multiscale and multiphysics coupling models for cardiovascular and cerebrovascular diseases, under review.
- Machine learning method for silicon chip health prediction (PI), with Huawei Technologies Co., Ltd, 510,000 RMB, in the process of signing the contract.
- Kunshan Government Research Fund (PI), The key technology and application of the intelligent management system of the comprehensive underground corridor, 1,000,000 RMB, 2020-2021.
- DKU Faculty Scholarship and Travel Award (PI), Mathematical model for Persistent post-Cortical Spreading Depress Vasoconstriction, 27,000 RMB, 2020-2021.
- DKU Teaching and Assessment Grant (PI), Active Learning Strategy in Mathematical Modelling: Interactive Academic Interview, 10,000 RMB, 2021-2022
- DKU Interdisciplinary Seed Grant (co PI), Mathematical modelling of spike trains synchrony underpinning memory, 75,000 RMB, 2021-2022.

## Publications

- 1 Energy Variational Approach for Ions Transport, **Shixin Xu**, Chun Liu and Ping Sheng, *Comm. Math. Sci.*, 12(4), 779-789, 2014.
- 2 Self-Consistent Approach to Global Charge Neutrality in Electrokinetics: A Surface Potential Trap Model, Li Wan, **Shixin Xu**<sup>#</sup>, Maijia Liao, Chun Liu, Ping Sheng, *Phys. Rev. X*, 4(1):011042, <http://dx.doi.org/10.1103/PhysRevX.4.011042>, 2014.
- 3 Deformation, Embolization, and Permeability of Partially Obstructive Blood Clots under Shear Flow, **Shixin Xu**, Zhiliang Xu, Oleg Kim, Rustem I. Litvinov, John W. Weisel, Mark Alber, J. R. Soc. Interface 14: 20170441. <http://dx.doi.org/10.1098/rsif.2017.0441>, 2017.
- 4 Derivation of a Continuum Model and the Energy Law for Moving Contact Lines with Insoluble Surfactants, Zhen Zhang, **Shixin Xu**, Weiqing Ren, *Phys. Fluids*, 26, 062103, 2014.
- 5 Strong Binding of Platelet Integrin  $\alpha\text{IIb}\beta\text{3}$  to Fibrin Clots: Potential Target to Destabilize Thrombi, Peter Hook, Rustem I. Litvinov, Oleg Kim, **Shixin Xu**, Zhiliang Xu, Joel Steven Bennett, Mark Alber, John W. Weisel, *Sci. Rep.* 7(1), DOI: 10.1038/s41598-017-12615-w, September 2017.
- 6 Numerical method for Multi-Alleles Genetic Drift Problem, **Shixin Xu**, Xinfu Chen, Chun Liu, Xingye Yue, *SIAM J. Numer. Anal.*, 57(4), 1770–1788, 2019.
- 7 A mathematical model for persistent post-CSD vasoconstriction, **Shixin Xu**, Joshua C. Chang, Carson C. Chow, K. C. Brennan, and Huaxiong Huang, *PLoS Comput. Biol.*, 16 (7), e1007996, 2020.

- 8 Tridomain Model for Potassium Clearance in Optic Nerve of Necturus, Yi Zhu, **Shixin Xu\***, Robert S. Eisenberg, and Huaxiong Huang, *Biophys. J.*, Volume 120, Issue 15, 3, Pages 3008-3027 DOI: 10.1016/j.bpj.2021.06.020, August 2021.
  - 9 Optic Nerve Microcirculation: Fluid Flow and Electrodiffusion, Yi Zhu, **Shixin Xu\***, Robert Eisenberg, Huaxiong Huang, *Phys. Fluids* 33, 041906, <https://doi.org/10.1063/5.0046323>, 2021.
  - 10 An energy stable  $C^0$  finite element scheme for a quasi-incompressible phase-field model of moving contact line with variable density, Lingyue Shen, Huaxiong Huang, Ping Lin, Zilong Song, **Shixin Xu\***, *J. Comput. Phys.*, Volume 405, 15, 109179, March 2020.
- An Energy Stable  $C^0$  Finite Element Scheme for A Phase-Field Model of Vesicle Motion and Deformation, Lingyue Shen, Zhiliang Xu, Ping Lin, Huaxiong Huang, **Shixin Xu\***, *SIAM J. Sci. Comput.*, accepted, 2021.
  - Numerical Method for Parameter Inference of Nonlinear ODEs with Partial Observations, Yu Chen, Jin Cheng, Arvind Gupta, Huaxiong Huang, **Shixin Xu\***, *R. Soc. Open Sci.*, 28 , <https://doi-org.proxy.lib.duke.edu/10.1098/rsos.210171>, July 2021.
  - Predicting the Risk of Rupture for Vertebral Aneurysm based on Geometric Features of Blood Vessels, Shixuan Li, Ruiqi Pan, Arvind Gupta, **Shixin Xu\***, Yibin Fang, and Huaxiong Huang, *R. Soc. Open Sci.* , 8: 210392. <https://doi.org/10.1098/rsos.210392>, 2021.
  - Homogenization of a discrete network model for chemical vapor infiltration process, Chun Xiao, **Shixin Xu**, Xingye Yue, Changjuan Zhang, Changrong Zhang, *Comm. Math. Sci.*, Vol. 19, No. 7, pp. 1809-1826 , 2021.
  - Modelling the linkage between influenza infection and cardiovascular events via thrombosis, McCarthy, Z., Rahman, **Shixin Xu**, et al., *Sci. Rep.* 10, 14264, 2020.
  - Non-Stokes Drag Coefficient in Single-Particle Electrophoresis: New Insights on a Classical Problem, Maijia Liao, Ming-Tzo Wei, **Shixin Xu**, H. Daniel Ou-Yang, Ping Sheng), *Chin. Phys. B* Vol. 28, No. 8, 084701, 2019.
  - Behavior of Different Numerical Schemes for the Population Genetic Drift Problems, **Shixin Xu**, Minxin Chen, Chun Liu, Xingye Yue, and Ran Zhang, *BIT Numer. Math.*, <https://doi.org/10.1007/s10543-019-00749-4> , 59(3), 797-821, 2019.
  - Multi-Scale Models of Deformation of Blood Clots, M Alber, **S. Xu**, Z Xu, O Kim, S Britton, R Litvinov, J Weisel, *Biophys. J.*, 116 (3), 323a, 2019.
  - A Bidomain Model on Lens Microcirculation, Yi Zhu, **Shixin Xu\***, Bob Eisenberg, Huaxiong Huang, *Biophys. J.*, 116 (6), 1171-1184 , 2019.
  - Three-phase Model of Visco-elastic Incompressible Fluid Flow and its Computational Implementation, **Shixin Xu**, Mark Alber, Zhiliang Xu, *Commun. Comput. Phys.*, 25 (2), 586-624, 2019.
  - Vertebral artery fusiform aneurysm geometry in predicting rupture risk, Xiukun Zhao, Nathan Gold, **Shixin Xu**, Yibin Fang, Yongxin Zhang, Jianmin Liu, Arvind Gupta, Huaxiong Huang, *Roy. Soc. Open. Sci.*, 5 (10), 180780, 2018.

- Homogenization Theory for Chemical Vapor Infiltration Process, Changjuan Zhang, Yun Bai, **Shixin Xu**, Xingye Yue, Comm. Math. Sci., 15(4), 1021-1040, 2017.
- Reinitialization of the Level Set Function in 3D Simulation of Moving Contact Lines, **Shixin Xu**, Weiqing Ren, Commun. Comput. Phys., 20(5), 1163-1182, 2016.
- Homogenization: in Mathematics or Physics, **Shixin Xu**, XingYe Yue, Discrete Cont. Dyn-S, 9(5), pp. 1575-1590, 2016.
- The Poisson Boltzmann Equation and the Charge Separation Phenomenon at the Silica-water Interface: A Holistic Approach, Maijia Liao, Li Wan, **Shixin Xu**, Chun Liu, Ping Sheng), Annals of Mathematical Science and Applications,1,217-249, 2016.
- Homogenization of Thermal-Hydro-Mass Transfer Processes, **Shixin Xu**, Xingye Yue, Discrete Cont. Dyn-S, 8(1), pp. 55 - 76, 2015.
- Numerical Simulations of Asymmetrical Conductance Changes in Gramicidin Pores, **Shixin Xu**, Minxin Chen, Sheereen Maja, Xingye Yue, and Chun Liu, Mol. Based Math. Biol., 2(1), ISSN (Online) 2299-3266, DOI: 10.2478/mlbmb-2014-0003, 2014.

( \* denotes corresponding author; # denotes co-first author.)

## Teaching and Mentoring

- Single Viable Calculus, Session2, Fall, 2019; Session3, spring, 2020
- Single Viable Calculus recitation, Session1, Fall, 2019
- Advanced Linear Algebra, Spring, Fall 2020, Spring 2021, all 2021.
- Mathematical Modeling, Fall,2020, Spring 2021, Fall 2021.
- Mathematics Department, Penn. State University.  
— Applied Calculus Recitation, Spring 2013.
- Advising 15 undergraduate students
- Mentoring 8 undergraduate students' signature work
- MCM\ICM 2020 3 Team Honorable Mention Awards
- MCM\ICM 2021 2 Teams Finalist Awards, 1 Team Meritorious Award, 3 Teams Honorable Mention Awards

## Presentations

- 09/19/2011, The 9<sup>th</sup> China National Computational Congress of Computational Mathematics, Zhengzhou, He Nan, P.R. China
- 05/28/2013, Workshop on Mathematical Modeling of Molecular Biology, Suzhou, China.
- 09/10/2013, The 2<sup>nd</sup> GSIS-RCPAM International Symposium "Geometric Function Theory and Applications in Sendai", Sendai, Japan.

- 12/25/2013, Workshop on Mathematical Models of Electrolytes with Application to Molecular Biology, Taipei, Taiwan.
- 07/01/2015, The 9th International Conference on Computational Physics, Singapore.
- 11/19/2015, American Physical Society Prairie Section Meeting, University of Notre Dame, US.
- 02/12/2016, The 8th International Bio-fluid Symposium, California Institute of Technology, US.
- 07/11/2016, SIAM, Life Science, Boston, US.
- 08/04/2016, Mechbio Symposium: Putting Together the Cell Mechanome, California Technology Institute, US. Finding the Pieces, building the Puzzle, University of California, San Diego, US.
- 08/28/2017, Workshop on Wave Transport of Ionic Species, Fields Institute, Toronto, Canada.
- 06/10/2019, CAIMS annual meeting, Fluid Dynamics/Industrial Applications, Whistler, Canada.
- 09/23/2019, United International College, Zhuhai, China.
- 01/24/2020, Soochow University, Suzhou, China.
- 01/20/2020, University of Science and Technology of China, Hefei, China.
- 09/18/2020, Wuhan University, Wuhan, China.
- 10/16/2020, Fudan University, Shanghai, China
- 06/28/2020, The Chinese University of Hong Kong, ShenZhen, Shenzhen, China.
- 07/23/2021, SIAM Annual Meeting
- 07/25/2021, University of Science and Technology of Beijing, Beijing China.
- 10/01/2021, Penn. State University, USA.

## Programming Language

C++, Matlab, Fortran, Python, Jupyter, Julia