Seyed Hamidreza Mofidi (Hamid Mofidi) - Curriculum Vitae

Beijing Institute of Mathematical Sciences (BIMSA),
Associated with Yau Center at Tsinghua University,
11th Building, Yanqi Island, Huairou District,
Beijing 101408, China

h.mofidi@bimsa.cn
hamidreza.mofidi@gmail.com
sites.google.com/view/hamid-mofidi
www.bimsa.cn/posdocs

Education and Employment Record

- **BIMSA center and YMSC Tsinghua University** — Beijing, China
  Postdoctoral Researcher — *November 2022 to present*
- **University of Iowa** — Iowa City, Iowa, USA
  Visiting Assistant Professor — *August 2020 to August 2022*
- **University of Kansas** — Lawrence, Kansas, USA
  Ph.D. and M.A. in Mathematics — *August 2014 to July 2020*
  Advisor: Prof. Weishi Liu
  Thesis Title: Electrodiffusion in Ionic Channels via PNP Models
- **Tarbiat Modares University** — Tehran, Iran
  M. Sc. in Applied Mathematics — *July 2008 to February 2011*
- **Amirkabir University of Technology (Tehran Polytechnic)** — Tehran, Iran
  B. Sc. in Pure Mathematics

Research Interests

- Mathematical neuroscience and nonlinear dynamics:
  - Bifurcation theory and Geometric Singular Perturbation theory to study multiple timescale neural dynamics and also investigating the dynamics of ionic channels.
  - Mathematical modeling techniques to interpret data in neuroscience.
- Mathematical biology meets deep learning:
  - Connections and interactions between deep learning models and neural dynamical systems of DEs using PINNs, Neural ODEs, and SINDy.
- Machine Learning and Neural Networks:
  - Theoretical deep learning: Infinite width networks, Bayesian learning and Kernel learning.
  - Investigating generative models: Diffusion models, GANs, etc.

Projects in Progress

- with W. Yang (BIMSA): *Applying PINNs on multiscale models for exploring neural activity dynamics.*
- with Sh. Lal (BIMSA): *Stochastic relaxation and diffusion probabilistic models for image restoration.*
- with Y. Wang (Brandeis University): *Effects of NMDA receptors on membrane excitation via Morris-Lecar Model.*
- with R. Curtu (University of Iowa) and W. Yang (BIMSA): *Neural Field Model With Spike Frequency Adaptation.*
- with M. Zhang (New Mexico Tech) and W. Liu(University of Kansas): *Effects of ion size on reversal potentials in ionic flows.*
- *Only author: Higher order contributions of permanent charges in ionic flows*

Publications and Preprints

- **H. Mofidi**, *Bifurcation of Flux Ratio in Ionic Flows via a PNP model (2023)* (**Article in arXiv**)
- W. Liu and **H. Mofidi**, *Local Hard-Sphere Poisson-Nernst-Planck Models for Ionic Channels with Permanent Charges. (Submitted) (2022)* (**Article in arXiv**)
- Y. Fu, W. Liu, **H. Mofidi**, and M. Zhang, *Finite ion size effects on ionic flows via PNP systems: Higher order contributions. Journal of Dynamics and Differential Equations, 2022.* (**Article in Springer**)
- **H. Mofidi**, *Geometric Mean of Concentrations and reversal permanent charge in Ionic Flows via PNP models.* Quarterly of Applied Mathematics 79 (4), 581-600 (2021)(**Article in AMS**)
- **H. Mofidi**, B. Eisenberg, W. Liu, *Effects of diffusion coefficients on reversal potentials in ionic channels.* Entropy **22** *(2020), 325(1-23).* (**Article in Entropy**)
- **H. Mofidi** and W. Liu, *Reversal potential and reversal permanent charge with unequal diffusion coefficients via PNP models. SIAM J. on Applied Math, 80 (2020), 1908-1935* (**Article in SIAM**)
- **H. Mofidi** and F. Hadadifard, *Weights guaranteeing polefree barycentric rational interpolation*, INDJST, Vol 6(11), 5450-5458, 2013. (**Article in INDJST**)
- **H. Mofidi**, Behzad Ghanbari, Mehdi gholami-porshokouhi, A class of iterative methods with cubic convergence to solve nonlinear equations, IJMA, Vol 4(8), 2013, 130-134 (**Article in IJMA**)

Grants and Fellowships

- Beijing Natural Science Foundation (BJNSF) project fund on Advances in denoising diffusion models, Fund amount per year: 100,000 CNY **Oct. 2023 to Oct. 2025**
- Simons Foundation travel grant, collaboration on dynamics of ionic channels at the University of Illinois, Chicago, **July 2019**

Honors and Academic Achievements

- Chair's Award for Outstanding Teaching and Scholarship, University of Iowa **April 2022**
- Paul F. Conrad Graduate Scholarship, University of Kansas **May 2020**
- U. G. MITCHELL Graduate Scholarship, University of Kansas **April 2016 and 2018**

Certificate Courses

- Coursera Deep Learning Specialization: Neural networks and deep learning, Hyperparameters Tuning, Structuring MLPs, Convolutional Neural Nets, Sequence Models
- Coursera Machine Learning Specialization: Supervised and Unsupervised ML, Reinforcement Learning, Advanced Learning Algorithms
- Python for Everybody Specialization: Python Data Structures, Using Databases with Python

Services

- Co-organizer of AI an Mathematics Seminar, Applied Math Group, BIMSA, **Fall 2023**
- Co-organizer of Mathematical Biology Seminar, Math Department, University of Iowa, **Spring 2022**
- Co-organizer of Fall Western Sectional Meeting, Special Session on Recent Advances in Studies of Electrodiffusion Phenomena, AMS, **October 2021**

Conferences, Seminars and Workshops

- The First International Congress of Basic Science (ICBS), July 2023.
- Applied and Computational Math Colloquium, Yau Math Center, Tsinghua University, April 2023:
  - **Presenter:** Exploring Ionic Channels and Cell Membranes Dynamics
- AMS, Special Session on Recent Advances in Studies of Electrodiffusion Phenomena, October 2021:
  - **Co-Organizer and Presenter:** Local HS PNP Models, Reversal Potential and Zero-Current Fluxes
- Society for Mathematical Biology Annual Conference, June 2021:
  - **Presenter:** Effects of Ion-Size on Zero-Current Fluxes in Ionic Flows Through Local Hard-Sphere PNP Models
- AMS, Special Session on Stochastic Modeling in Mathematical Biology, September 2020:
  - **Presenter:** Diffusion Coefficients and Reversal Permanent Charge in Ionic Channels
- Math Biology Seminar, University of Iowa, August 2020:
  - **Presenter:** Electrodiffusion in ionic channels via PNP models
- The Southeast Center for Mathematics and Biology, the 2020 SCMB Annual Symposium, Feb 2020:
  - **Poster:** Effects of diffusion coefficients on reversal potentials in ionic channels.
- Colloquium talk, New Mexico Tech, Socorro, NM, October 2019:
  - **Presenter:** Dynamics inside ionic channels: A comparison to Goldman-Hodgkin-Katz equation.
- CAM Seminar, University of Kansas, November 2019:
  - **Presenter:** Zero current fluxes via Poisson-Nernst-Planck models.
- **Visiting Ph.D. candidate** with Prof. Robert(Bob) Eisenberg, on mathematical modeling of ionic solutions, University of Illinois at Chicago, July 2019.
- SIAM Conference on Applications of Dynamical Systems (Snowbird), May 2019.
  - **Presenter:** Reversal permanent charge: Case studies via classical PNP models with diffusion.
- Workshop on Nonlinear DEs, Dynamical Systems and Applications, University of Kansas, October 2018:
  - **Poster:** Effects of permanent charges and ion sizes on ionic fluxes.
- The 4th Annual Meeting of SIAM Central States Section: Recent Advances in Modeling, Numerics, and Analysis of Electrodiffusion Phenomena, University of Oklahoma Norman, October 2018.
  - **Presenter:** PNP systems with hard-sphere models and permanent charges.
- Differential Equations Seminar, University of Missouri, Columbia, MO, September 2018:
  - **Poster:** Hard-Sphere Poisson-Nernst-Planck models for ion channels.
- John Barrett Memorial Lectures on Mean Curvature Flow, The University of Tennessee, May 2018.
- Houston Summer School on Dynamical Systems, University of Houston, TX, May 2018.
- PDE, Dynamical Systems and Applications Conference, University of Kansas, April 2018.
- Workshops on Multiscale Mathematics and Computing in Science and Engineering hosted by Institute for Mathematics and its Applications (IMA), University of Minnesota:
  - Electrohydrodynamics and Electrodiffusion in Material Sciences and Biology, March 2018.
- Graduate Student Seminar, University of Kansas, Lawrence, KS, September 2018:
  - **Presenter:** Dynamics of Poisson-Nernst-Planck systems and applications to ionic channels with hard-sphere models and permanent charges.

- Prairie Analysis Seminar on Harmonic Analysis and PDEs, University of Kansas, September 2016.
- KUMU PDE Conference, University of Kansas, April 2015.
- The 6th International Seminar on Linear Algebra and Its Applications, Arak University, Iran, 2011:
  - **Presenter:** Applications of new weights on Barycentric rational interpolation.
- 41st Annual Iranian Mathematics Conference, Urmia University, Urmia, Iran, 2010:
  - **Presenter:** Pade Approximation and Barycentric Rational Interpolation.
- 40th Annual Iranian Mathematics Conference, Sharif University, Tehran, Iran, 2009.

Journal Reviewed

- Journal of Numerical Analysis, Industrial and Applied Mathematics, Studies in Applied Mathematics, Mathematics (MDPI) open access journal, Symmetry (MDPI), Material (MDPI)

Teaching Experience

- Visiting Assistant Professor: *Department of Mathematics, University of Iowa,* **Fall 2020 – Fall 2022**
  - Instructor of Record:
    - Differential Equations for Engineering, Fall, Spring, Winter 2020 and 2021
    - Calculus 2 and Calculus 3, Spring 2022
    - Business Calculus I, Spring 2020, Fall 2021
- Graduate Teaching Assistant: *Department of Mathematics, University of Kansas,* **Fall 2014 – Fall 2020**
  - Instructor of Record:
    - Engineering Calculus III, Summer 2017,19 and 2020
    - Business Calculus I, Fall 2014, Spring 2015, Spring 2016
  - Teaching Assistant and grader: (University of Kansas)
    - Measure Theory and Real Analysis, Fall 2016
    - Complex Analysis, Spring 2019
    - Applied Linear Algebra, Spring 2018
  - Lab Section GTA: (University of Kansas)
    - Engineering Calculus III, Spring 2018, Fall 2017, 2018
    - Engineering Calculus II, Spring 2017 and 2019
    - Engineering Calculus I, Fall 2016, Pre-Calculus, Fall 2015
  - Analysis Qualifying Exam Seminar Leader, Spring 2015:
    - Organized and presented weekly seminars to help prepare graduate students for the Ph.D. qualifying exam in analysis.
- Lecturer: A.B.A Higher Education Institution, Abyek, Qazvin, Iran, 2007-2009 and 2011-2014:
  Differential Equations, Statistics and Probability, Engineering Mathematics,
  Discrete Mathematics, Applied Calculus.
- Lecturer: Cambridge School run by Pakistan Embassy in Tehran, Iran, 2012-2014:
  Mathematics 2, 3 and 4, Pure Mathematics 1, 2 and 3.

Languages

- **Farsi/Persian:** Native Speaker, **English:** Proficient, **Chinese:** Elementary

Software Skills

- Python, MATLAB, Julia, Mathematica
  Bifurcation software: XPP/Auto, MatCont.