# Mohammad Mirzadeh


CONTACT INFORMATION

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RESEARCH INTERESTS

Transport in Random Media, Fluid Mechanics & Electrokinetics, Moving Boundary Problems, Data-Driven Modeling, Adaptive Mesh Refinement, Parallel Computing.

EDUCATION

**University of California Santa Barbara**, Santa Barbara, California, USA

Ph.D., Mechanical Engineering, 2008 - 2014

- Dissertation Topic: "Discretization of Poisson-Boltzmann and Poisson-Nernst-Planck Equations with Applications to Electrochemical Systems"
- Advisors: **Prof. Frederic Gibou** and **Prof. Todd Squires**

**University of Tehran**, Tehran, Tehran, Iran

B.S., Mechanical Engineering, 2003-2008

ACADEMIC EXPERIENCE

**Department of Chemical Engineering, MIT**, Cambridge, Massachusetts, USA

*Postdoctoral Associate:* Working with **Prof. Martin Bazant** **September 2015 - *present***

*Conference organizer:* **June 12-14, 2019 - Cambridge, MA**
Co-organizer and the Head of Local Organizing Committee for the 13th International Symposium on Electrokinetics at MIT.

**University of California Santa Barbara**, Santa Barbara, California, USA **2008 - 2014**

*Graduate Student:* Includes Ph.D. research and Ph.D./M.S. level coursework and research projects.

*Teaching Assistant:* Duties at various times have included office hours and paper grading for several undergraduate courses related to Fluid Mechanics, Heat Transfer, Thermodynamics, and MATLAB programming.

*Journal Reviewer* **2012 - *present***
Reviewed submitted manuscripts to *Journal of Computational Physics*, *Journal of Scientific Computing*, *Physical Chemistry Chemical Physics*, *Physics of Fluids*, *Journal of Fluid Mechanics*, *Physical Review Fluids*, *Physical Review E*, *Langmuir*, and *Journal of Physics D*.

GRANT WRITING EXPERIENCE

**Grant Co-author - $150,000 awarded (2017)**
Co-authored a successful proposal to the MIT Energy Initiative for experimental study of electrokinetic control of viscous fingering

**Grant Co-author - $130,000 (*equivalent*) awarded (2014)**
Co-authored a successful research proposal for computational resources to NSF's "Extreme Science and Engineering Discovery Environment" (XSEDE) program.

AWARDS

**Best Ph.D. Dissertation Award (2014)**
Best Ph.D. dissertation award from the Department of Mechanical Engineering, UC Santa Barbara.

**Excellence Fellowship (2012)**
Excellence Fellowship from the Department of Mechanical Engineering, UC Santa Barbara.

## Submitted Articles

**4)** D. Fraggedakis, **M. Mirzadeh**, T. Zhou, and M. Z. Bazant, "Dielectric breakdown by electric-field induced phase separation", *under review*, arXiv:2005.11466

**3)** **M. Mirzadeh**, T. Zhou, M. A. Amooie, D. Fraggedakis, T. R. Ferguson, and M. Z. Bazant, "Vortices of Electro-osmotic Flow in Heterogeneous Porous Media", *under review*, arXiv:2003.05974

**2)** T. Zhou, **M. Mirzadeh**, R.J. Pellenq, and M. Z. Bazant, "Freezing point depression and freeze-thaw damage by nano-fuidic salt trapping", *under review*, arXiv:1905.07036.

**1)** T. Zhou, **M. Mirzadeh**, D. Fraggedakis, R.J. Pellenq, and M. Z. Bazant, "Theory of Freezing Point Depression in Charged Porous Media", *under review*, arXiv:1909.09332.

## Journal Publications

**11)** A. Sayyah[†], **M. Mirzadeh**[†], Y. Jiang, W. V. Gleason, W. C. Rice, and M. Z. Bazant, "Physics of Electrostatic Projection Revealed by High-Speed Video Imaging", *Physical Review Applied*, 13, 034071 ([†]*equal contributions*)

**10)** T. Gao[†], **M. Mirzadeh**[†], P. Bai, K. M. Conforti, and M. Z. Bazant, "Active Control of Viscous Fingering Using Electric Fields", *Nature Communications*, 10, 1-8 (2019). ([†]*equal contributions*)

**9)** T. Zhou, K. Ioannidou, E. Masoero, **M. Mirzadeh**, R. J. Pellenq, and M. Z. Bazant. "Capillary stress and structural relaxation in moist granular materials", *Langmuir*, 35, 4397-402 (2019).

**8)** **M. Mirzadeh** and M. Z. Bazant, "Electrokinetic Control of Viscous Fingering", *Physical Review Letters*, 119, 174501 (2017).

**7)** **M. Mirzadeh**, A. Guittet, C. Burstedde, and F. Gibou, "Parallel Level-set Methods on Adaptive Tree-Based Grids", *Journal of Computational Physics*, 322, 345–364 (2016).

**6)** **M. Mirzadeh**, F. Gibou, and T. M. Squires, "Enhanced Charging Kinetics of Porous Electrodes: Surface Conduction as a Short Circuit Mechanism", *Physical Review Letters*, 113, 097701 (2014).

**5)** **M. Mirzadeh** and F. Gibou, "A conservative discretization of Poisson-Nernst-Planck equations on adaptive Cartesian grids.", *Journal of Computational Physics*, 274, 633–653 (2014).

**4)** **M. Mirzadeh**, M. Theillard, A. Helgadottir, D. Boy, and F. Gibou, "An Adaptive, Finite Difference Solver for the Non-linear Poisson-Boltzmann Equation with Applications to Biomolecular Computations", *Communications in Computational Physics*, 13, 150–173 (2013).

**3)** A. Nabi, **M. Mirzadeh**, F. Gibou, and J. Moehlis, "Minimum Energy Desynchronizing Control for Coupled Neurons", *Journal of Computational Neuroscience*, 34, 259–271 (2013).

**2)** A. Nabi, **M. Mirzadeh**, F. Gibou, and J. Moehlis, "Minimum Energy Spike Randomization for Neurons", *Proceedings of the 2012 American Control Conference*, 4751–4756 (2012).

**1)** **M. Mirzadeh**, M. Theillard, and F. Gibou, F. "A second-order discretization of the nonlinear Poisson-Boltzmann equation over irregular geometries using non-graded adaptive Cartesian grids", *Journal of Computational Physics*, 230, 2125–2140 (2011).

## Computer Skills

- *Programming Languages*: `C, C++, Python, MATLAB`.
- *Machine Learning Frameworks*: `Familiar with TensorFlow and Scikit-Learn`.
- *Parallel Programming*: `MPI and OpenMP. Familiar with CUDA`.
- *Software Development*: `git, CMake, GNU make`.