

# Stanford

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## Ali Mani

Associate Professor of Mechanical Engineering

### CONTACT INFORMATION

- **Alternate Contact**

Tel 6507251325

### Bio

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#### BIO

Our research is broadly defined by multiphysics problems in fluid dynamics and transport engineering. Our work contributes to the understanding of these problems primarily through theoretical tools such as techniques of applied mathematics as well as massively-parallel simulations. Numerical simulations enable quantitative visualization of the detailed physical processes which can be difficult to detect experimentally. They also provide quantitative data that guide the development of reduced-order models, which would naturally induce insight for design, optimization and control. Most of our work involves complementary interactions with experimental groups within and outside of Stanford. Specific current research topics include:

- (1) Electro-convection and microscale chaos near electrochemical interfaces
- (2) Particle-laden flows with applications in solar receivers
- (3) Applications of superhydrophobic surfaces for drag reduction of turbulent flows
- (4) Micro-bubble generation by breaking waves
- (5) Electrokinetics of micropores and nanopores

#### ACADEMIC APPOINTMENTS

- Associate Professor, Mechanical Engineering
- Affiliate, Precourt Institute for Energy
- Member, Institute for Computational and Mathematical Engineering (ICME)

#### PROFESSIONAL EDUCATION

- PhD, Stanford University , Mechanical Engineering (2009)
- M.S., Stanford University , Mechanical Engineering (2004)
- B.S., Sharif University of Technology , Mechanical Engineering (2002)

## LINKS

- Mani Research Lab: <http://www.stanford.edu/~alimani>

## Teaching

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### COURSES

#### 2019-20

- Fluid Mechanics: ME 351B (Win)
- Introduction to Numerical Methods for Engineering: CME 206, ME 300C (Spr)
- Seminar in Fluid Mechanics: ENGR 298 (Aut)

#### 2018-19

- Asymptotic Methods in Computational Engineering: ME 405 (Win)
- Fluid Mechanics: ME 351A (Aut)
- Introduction to Numerical Methods for Engineering: CME 206, ME 300C (Spr)

#### 2017-18

- Fluid Mechanics: ME 351A (Aut)
- Fluid Mechanics: ME 351B (Win)

#### 2016-17

- Physics-Based Computational Modeling: ME 405 (Win)
- Turbulence: ME 361 (Spr)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Ronald Chan, Ji Hoon Kim, Pedro Montebello Milani, Suhas Suresh, Hilario Torres

#### Postdoctoral Faculty Sponsor

Seyedshahabaddin Mirjalili

#### Doctoral Dissertation Advisor (AC)

Raj Balaji, Dana Lynn Lansigan, Jessie Liu, Kimberly Liu, Danah Park, Omkar Shende, yasaman shirian

#### Master's Program Advisor

Hannah Williams

#### Doctoral Dissertation Co-Advisor (AC)

Taemin Yong

## Publications

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### PUBLICATIONS

- **Chaotic induced-charge electro-osmosis.** *Physical review letters*  
Davidson, S. M., Andersen, M. B., Mani, A.  
2014; 112 (12): 128302-?
- **Overlimiting Current and Shock Electrodialysis in Porous Media** *LANGMUIR*  
Deng, D., Dydek, E. V., Han, J., Schlumpberger, S., Mani, A., Zaltzman, B., Bazant, M. Z.

2013; 29 (52): 16167-16177

- **Direct numerical simulation of electroconvective instability and hydrodynamic chaos near an ion-selective surface** *PHYSICS OF FLUIDS*  
Druzgalski, C. L., Andersen, M. B., Mani, A.  
2013; 25 (11)
- **Current-Induced Membrane Discharge** *PHYSICAL REVIEW LETTERS*  
Andersen, M. B., van Soestbergen, M., Mani, A., Bruus, H., Biesheuvel, P. M., Bazant, M. Z.  
2012; 109 (10)
- **Analysis and optimization of numerical sponge layers as a nonreflective boundary treatment** *JOURNAL OF COMPUTATIONAL PHYSICS*  
Mani, A.  
2012; 231 (2): 704-716
- **Physics and Computation of Aero-Optics** *ANNUAL REVIEW OF FLUID MECHANICS, VOL 44*  
Wang, M., Mani, A., Gordeyev, S.  
2012; 44: 299-321
- **Deionization shocks in microstructures** *PHYSICAL REVIEW E*  
Mani, A., Bazant, M. Z.  
2011; 84 (6)
- **Overlimiting Current in a Microchannel** *PHYSICAL REVIEW LETTERS*  
Dydek, E. V., Zaltzman, B., Rubinstein, I., Deng, D. S., Mani, A., Bazant, M. Z.  
2011; 107 (11)
- **Electroosmotic pump performance is affected by concentration polarizations of both electrodes and pump** *SENSORS AND ACTUATORS A-PHYSICAL*  
Suss, M. E., Mani, A., Zangle, T. A., Santiago, J. G.  
2011; 165 (2): 310-315
- **Effects of Constant Voltage on Time Evolution of Propagating Concentration Polarization** *ANALYTICAL CHEMISTRY*  
Zangle, T. A., Mani, A., Santiago, J. G.  
2010; 82 (8): 3114-3117
- **Prediction of Sound Generated by Complex Flows at Low Mach Numbers** *AIAA JOURNAL*  
Khalighi, Y., Mani, A., Ham, F., Moin, P.  
2010; 48 (2): 306-316
- **Theory and experiments of concentration polarization and ion focusing at microchannel and nanochannel interfaces** *CHEMICAL SOCIETY REVIEWS*  
Zangle, T. A., Mani, A., Santiago, J. G.  
2010; 39 (3): 1014-1035
- **Suitability of artificial bulk viscosity for large-eddy simulation of turbulent flows with shocks** *JOURNAL OF COMPUTATIONAL PHYSICS*  
Mani, A., Larsson, J., Moin, P.  
2009; 228 (19): 7368-7374
- **Computational study of optical distortions by separated shear layers and turbulent wakes** *JOURNAL OF FLUID MECHANICS*  
Mani, A., Moin, P., Wang, M.  
2009; 625: 273-298
- **On the Propagation of Concentration Polarization from Microchannel-Nanochannel Interfaces Part I: Analytical Model and Characteristic Analysis** *LANGMUIR*  
Mani, A., Zangle, T. A., Santiago, J. G.  
2009; 25 (6): 3898-3908
- **On the Propagation of Concentration Polarization from Microchannel-Nanochannel Interfaces Part II: Numerical and Experimental Study** *LANGMUIR*  
Zangle, T. A., Mani, A., Santiago, J. G.  
2009; 25 (6): 3909-3916
- **Resolution requirements for aero-optical simulations** *JOURNAL OF COMPUTATIONAL PHYSICS*  
Mani, A., Wang, M., Moin, P.

2008; 227 (21): 9008-9020

- **Statistical description of the free-space propagation of highly aberrated optical beams** *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA A-OPTICS IMAGE SCIENCE AND VISION*

Mani, A., Wang, M., Moin, P.

2006; 23 (12): 3027-3035