

HASSAN ARBABI

[Website](#) - [Google Scholar](#) - [Github](#)

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RESEARCH INTERESTS

- Data-driven analysis, prediction and control of high-dimensional systems, with application to climate, fluids, biology and biomedical engineering.
- Probabilistic characterization and real-time prediction of extreme events.
- Numerical algorithms for system identification, data analysis and fluid flows.
- Transport and mixing in geophysical and biological flows.

CURRENT POSITION(S)

Johns Hopkins University September 2019 - present
Visiting Scholar, Department of Chemical and Biomolecular Engineering
Host: Yannis Kevrekidis

Massachusetts Institute of Technology June 2018 - present
Postdoctoral Scholar, Mechanical Engineering Department
Supervisor: Themistoklis Sapsis

EDUCATION

University of California, Santa Barbara January 2018
PhD in Mechanical Engineering, *Santa Barbara, CA*
with emphasis on Dynamical Systems, Control & Computational Science.
Thesis: *Koopman spectral analysis and mixing in incompressible flows*
Advisor: Igor Mezić

University of Tehran September 2012
M.Sc. in Mechanical Engineering, with emphasis on Thermofluids. *Tehran, Iran*
Thesis: *Linear stability analysis of pulsating flow in constricted channels*
Advisor: Keyvan Sadeghy

HONORS AND AWARDS

Best PhD Thesis Award, *Center for Control, Dynamical Systems and Computation (CCDC)*, UC Santa Barbara, 2019.

Best PhD Thesis Award, *Mechanical Engineering Department*, UC Santa Barbara, 2018.

3rd Madrid Turbulence Workshop Fellowship, *Universidad Politécnica de Madrid*, 2017.

Holbrook Foundation Fellowship, *Institute for Energy Efficiency*, UC Santa Barbara, 2014-2015.

RESEARCH & WORK EXPERIENCE

Dynamical Systems Lab, UCSB September 2013 - May 2018
Graduate & Post-Graduate Researcher *Santa Barbara, CA*

- Developing data-driven algorithms for analysis of nonlinear and high-dimensional dynamical systems using the Koopman operator formalism - *with application to extracting spatio-temporal patterns from geophysical and biological flows.*

- Analysis of ocean velocity data and computation of mixing maps to predict the motion of oil slicks, plane debris, etc. - *with application to design of search algorithms for the missing Malaysian Airline plane (MH370), and prediction of the oil slick movement in 2015 Refugio Oil Spill.*
- Mentoring and supervising 7 undergraduate interns over various research projects.

Department of Mechanical Engineering, UCSB
Teaching Assistant and Guest Lecturer

September 2012 - December 2016
Santa Barbara, CA

- Guest lecturer in Vibration, Applied Dynamical Systems Theory, and Operator Theory.
- Teaching Assistant in Vibration, Engineering Dynamics, Fluid Mechanics and Thermal Sciences.

Renewable Energies Institute, Department of Energy
Research Engineer

August 2010 - December 2011
Tehran, Iran

- Developing an ArcGIS framework for optimal geographic siting of wind farms.

PUBLICATIONS

H. Arbabi, J. Bunder, G. Samaey, A. Roberts and Y. Kevrekidis, *Linking Machine Learning with Multiscale Numerics: Data-Driven Discovery of Homogenized Equations*, 2020, to appear in Journal of Mechanics [[preprint](#)].

H. Arbabi, and T. Sapsis. *Generative stochastic modeling of strongly nonlinear chaotic systems with non-Gaussian statistics*, 2020, submitted [[preprint](#)].

S. Ivić, B. Crnković, H. Arbabi, P. Clary, S. Loire and I. Mezić. *Search strategy in a complex and dynamic environment: the case of MH370*, 2020, to appear in Scientific Reports [[preprint](#)].

H. Arbabi, and I. Mezić. *Spectral analysis of mixing in 2D high-Reynolds flows*, 2020, submitted [[preprint](#)].

H. Arbabi, and I. Mezić. *Prandtl-Batchelor theorem for flows with quasi-periodic time dependence*, 2019, Journal of Fluid Mechanics [[preprint](#)].

H. Arbabi, M. Korda and I. Mezić. *A data-driven Koopman model predictive control framework for nonlinear flows*, 2019, submitted [[preprint](#)].

H. Arbabi and I. Mezić. *Ergodic theory, dynamic mode decomposition and computation of the Koopman spectral properties*, 2017, SIAM J. on Applied Dynamical Systems [[preprint](#)].

H. Arbabi and I. Mezić. *Study of dynamics in post-transient flows using Koopman mode decomposition*, 2017, Physical Review Fluids [[preprint](#)].

H. Arbabi, M. Korda and I. Mezić. *A data-driven Koopman model predictive control framework for nonlinear partial differential equations*, 2018, Proceedings of 57th IEEE Conference on Decision and Control (CDC).

I. Mezić and H. Arbabi. *On the Computation of Isostables, Isochrons and Other Spectral Objects of the Koopman Operator Using the Dynamic Mode Decomposition*, 2017, NOLTA [[reprint](#)].

N. Govindarajan, H. Arbabi, L. van Blargian, T. Matchen, E. Tegling and I. Mezić. *An operator-theoretic viewpoint to non-smooth dynamical systems: Koopman analysis of a hybrid pendulum*, 2016, Proceedings of 55th IEEE Conference on Decision and Control (CDC) [[preprint](#)].

CONFERENCE PRESENTATIONS

- H. Arbabi, T. Sapsis, *Data-driven modeling of flows with non-Gaussian statistics*, 72th Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA, November 2019.
- H. Arbabi, T. Sapsis, *Stochastic model reduction for spatio-temporal systems with continuous spectrum*, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 2019.
- H. Arbabi, M. Korda, I. Mezić, *Nonlinear PDE Control using the Koopman Operator Theory*, SIAM Annual Meeting, Portland, Oregon, July 2018 .
- H. Arbabi, I. Mezić, *Computation of Koopman spectrum for complex flows*, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 2017.
- H. Arbabi, I. Mezić, *Convergence of dynamic mode decomposition to Koopman spectra for post-transient flows*, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR, November 2016.
- B. Emery, L. Washburn, I. Mezić, S. Loire, H. Arbabi, C. Ohlmann, J. Harlan, *Oil Spill Trajectories from HF Radars: Applied Dynamical Systems Methods vs. Lagrangian Stochastic Model*, AGU Fall Meeting, Poster Session, 2016.
- H. Arbabi, I. Mezić, *Bifurcations of driven cavity flow and their implications for mixing*, 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA, November 2015.
- H. Arbabi, I. Mezić, *On the relationship between Koopman mode decomposition and dynamic mode decomposition*, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 2015.
- H. Arbabi, I. Mezić, *Bifurcations and mixing in lid-driven cavity flow* , 9th Southern California Symposium on Fluid Mechanics, San Diego, CA, April 2015.
- H. Arbabi, I. Mezić, *Applications of Koopman operator theory to model reduction in fluid mechanics*, 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA, November 2014.
- S. Loire, H. Arbabi, P. Clary, Stefan Ivic, Bojan Crnkovic, Igor Mezić, *Search strategy in a complex and dynamic environment*, 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA, November 2014.
- H. Arbabi, Igor Mezić, *Nonlinear flow analysis via Koopman operator*, 8th Southern California 8th Symposium on Fluid Mechanics, Los Angeles, CA, April 2014.

SKILLS, MEMBERSHIP & ACADEMIC SERVICE

Peer review	J. of Fluid Mechanics, Pro. of Royal Soc., J. of Nonlinear Dynamics, AIAA J., SIAM J. App. Dyn. Sys., SIAM J. Sci. Comp., IEEE Trans. Big Data
Programming	Experienced in Python, MATLAB and FORTRAN(+PETSC). Novice in C and HTML.
Software	Microsoft Office, L ^A T _E X, ParaView, ArcGIS, Beamer.
Language	Farsi & English.
Membership	SIAM, APS