

Abhishek Halder

CONTACT INFORMATION	BE 365b Jack Baskin School of Engineering University of California, Santa Cruz, CA 95064 USA	+1-979-583-6070 ahalder@ucsc.edu abhishekhalder.org
PROFESSIONAL APPOINTMENTS	Assistant Professor Department of Applied Mathematics and Statistics University of California, Santa Cruz	October 2017 – Current
	Postdoctoral Scholar Department of Mechanical and Aerospace Engineering University of California, Irvine – Topic: <i>Stochastic control, filtering and optimal transport</i> – Host: Tryphon T. Georgiou	February 2017 – September 2017
	Postdoctoral Research Associate Department of Electrical and Computer Engineering Texas A&M University – Topic: <i>Demand response in smart grid, unmanned aerial systems traffic management</i> – Host: P.R. Kumar	June 2014 – January 2017
	Global Research Innovation and Technology Intern Systems Modeling and Control Eaton Corporation, Eden Prairie, Minnesota – Topic: <i>Voltage Control in UPS: Modeling, Controller Synthesis, and Hardware-in-loop Simulation</i> – Host: Yigang Wang – Projects: (1) Model Based Design in Power Electronics (2) Co-operative Control of Generator and UPS	Summer 2013
	Visiting Researcher Dynamics and Control, Coordinated Science Laboratory University of Illinois at Urbana-Champaign – Topic: <i>Nonlinear Estimation as Gradient Flow</i> – Host: Prashant Mehta	Summer 2012
	Research Intern Advanced Systems Development Section, Control Systems Group Indian Space Research Organization Satellite Center (ISAC), Bangalore INDIA – Topic: <i>A Study of Petri Nets: Modeling, Analysis and Simulation</i> – Host: Dr. A. Venkateswarlu, Deputy Director, CSG, ISAC	Summer 2006
EDUCATION	Ph.D. in Aerospace Engineering Texas A&M University, College Station, Texas USA	May 2014

- Dissertation: *Probabilistic Methods for Model Validation*
(**Outstanding Doctoral Student Award**)
- Advisor: Raktim Bhattacharya

Bachelors and Masters in Aerospace Engineering

July 2008

Indian Institute of Technology Kharagpur, West Bengal INDIA

- Thesis: *Development of An Autonomous Reconfigurable UAV*
(**Best Dual Degree Thesis Award**)
- Advisor: Manoranjan Sinha

RESEARCH
INTERESTS

Broad area

Systems, control and optimization

Theory focus

- Dynamics and control of stochastic systems
- Uncertainty propagation and nonlinear estimation
- Monge-Kantorovich optimal transport
- Randomized algorithms
- Density control

Application focus

- Application of density control in aerial robotics, and energy systems
- Cyberphysical systems
- Model validation, controller robustness verification, model reduction
- Data driven modeling for control, optimization and machine learning

JOURNAL
PUBLICATIONS

- J11.** A. Halder, X. Geng, P.R. Kumar, and L. Xie. Architecture and Algorithms for Privacy Preserving Thermal Inertial Load Management by A Load Serving Entity. *IEEE Transactions on Power Systems*. 32(4):3275–3286, 2017. [**Paper selected by the IEEE Power & Energy Society (PES) Technical Committee for presentation in 2017 PES General Meeting.**]
doi:10.1109/TPWRS.2016.2628055
- J10.** A. Halder, K. Lee, and R. Bhattacharya. A Probabilistic Method for Nonlinear Robustness Analysis of F-16 Controllers. *Journal of Guidance, Control, and Dynamics*. 38(10):1935–1946, 2015.
doi:10.2514/1.G000386
- J9.** P. Dutta, A. Halder, and R. Bhattacharya. Nonlinear Estimation with Perron-Frobenius Operator and Karhunen-Loève Expansion. *IEEE Transactions on Aerospace and Electronic Systems*. 51(4):3210-3225, 2015.
doi:10.1109/TAES.2015.140591
- J8.** K. Lee, A. Halder, and R. Bhattacharya. Performance and Robustness Analysis of Stochastic Jump Linear Systems using Wasserstein Metric. *Automatica*. 51:341–347, 2015.
doi:10.1016/j.automatica.2014.10.080
- J7.** A. Halder, and R. Bhattacharya. Probabilistic Model Validation for Uncertain Nonlinear Systems. *Automatica*. 50(8):2038–2050, 2014.
doi:10.1016/j.automatica.2014.05.026

- J6.** T. Kalmár-Nagy, P. Wahi, and **A. Halder**. Dynamics of a Hysteretic Relay Oscillator with Periodic Forcing. *SIAM Journal on Applied Dynamical Systems*, 10(2):403–422, 2011.
doi:10.1137/100784606
- J5.** **A. Halder**, and R. Bhattacharya. Dispersion Analysis in Hypersonic Flight During Planetary Entry Using Stochastic Liouville Equation. *Journal of Guidance, Control and Dynamics*, 34(2):459–474, 2011.
doi:10.2514/1.51196
- J4.** S. Ghosh, **A. Halder**, and M. Sinha. Micro Air Vehicle Path Planning in Fuzzy Quadtree Framework. *Applied Soft Computing*, 11(8):4859–4865, 2011.
doi:10.1016/j.asoc.2011.06.014
- J3.** S. Zhao, **A. Halder**, and T. Kalmár-Nagy. Nonlinear Dynamics of Unicycles in Leader-Follower Formation. *Communications in Nonlinear Science and Numerical Simulations*, 14(12):4204–4219, 2009.
doi:10.1016/j.cnsns.2009.02.028
- J2.** S. Chauhan, C. Patil, M. Sinha, and **A. Halder**. Fuzzy State Noise Driven Kalman Filter for Sensor Fusion. *Journal of Aerospace Engineering, Proceedings of the Institution of Mechanical Engineers, Part G*, 223(8):1091–1097, 2009.
doi:10.1016/j.cnsns.2009.02.028
- J1.** **A. Halder**, R. Garhwal, V. Agarwal, and M. Sinha. Determination of Inertial Characteristics of A High Wing Unmanned Air Vehicle. *Journal of Institute of Engineers (India)*, 223:3–8, 2008.

CONFERENCE
PUBLICATIONS

- C24.** **A. Halder**, and T.T. Georgiou. Gradient Flows in Uncertainty Propagation and Filtering of Linear Gaussian Systems. *56th IEEE Conference on Decision and Control*, Melbourne, 2017.
doi:
- C23.** **A. Halder**, and E.D.B. Wendel. Finite Horizon Linear Quadratic Gaussian Density Regulator with Wasserstein Terminal Cost. *American Control Conference*, Boston, 2016.
doi:10.1109/ACC.2016.7526817
- C22.** **A. Halder**, X. Geng, G. Sharma, L. Xie, and P.R. Kumar. A Control System Framework for Privacy Preserving Demand Response of Thermal Inertial Loads. *IEEE International Conference on Smart Grid Communications (SmartGridComm 2015)*, Miami, 2015, pp. 181–186.
doi:10.1109/SmartGridComm.2015.7436297
- C21.** **A. Halder**, K. Lee, and R. Bhattacharya. A Dynamical System Pair with Identical First Two Moments But Different Probability Densities. **Invited Paper**, *53rd IEEE Conference on Decision and Control*, Los Angeles, 2014.
doi:10.1109/CDC.2014.7040335
- C20.** **A. Halder**, and R. Bhattacharya. Geodesic Density Tracking with Applications to Data Driven Modeling. **Invited Paper**, *American Control Conference*, Portland, 2014.
doi:10.1109/ACC.2014.6859361
- C19.** K. Lee, **A. Halder**, and R. Bhattacharya. Probabilistic Robustness Analysis of Stochastic Jump Linear Systems. *American Control Conference*, Portland, 2014.
doi:10.1109/ACC.2014.6859432

- C18.** A. Halder, and R. Bhattacharya. Frequency Domain Model Validation in Wasserstein Metric. *American Control Conference*, Washington DC, 2013.
doi:10.1109/ACC.2013.6580754
- C17.** A. Halder, K. Lee, and R. Bhattacharya. Probabilistic Robustness Analysis of F-16 Controller Performance: An Optimal Transport Approach. *American Control Conference*, Washington DC, 2013.
doi:10.1109/ACC.2013.6580708
- C16.** P. Dutta, A. Halder, and R. Bhattacharya. Nonlinear Filtering with Transfer Operator. *American Control Conference*, Washington DC, 2013.
doi:10.1109/ACC.2013.6580302
- C15.** A. Halder, and R. Bhattacharya. Further Results on Probabilistic Model Validation in Wasserstein Metric. *51st IEEE Conference on Decision and Control (CDC)*, Maui, Dec. 2012.
doi:10.1109/CDC.2012.6425987
- C14.** P. Dutta, A. Halder, and R. Bhattacharya. Uncertainty Quantification for Stochastic Nonlinear Systems with Perron-Frobenius Operator and Karhunen-Loève Expansion. *IEEE Multi-Conference on Systems and Control*, Dubrovnik, Croatia, Oct. 2012.
doi:10.1109/CCA.2012.6402455
- C13.** A. Halder, and R. Bhattacharya. Model Validation: A Probabilistic Formulation. *50th IEEE Conference on Decision and Control (CDC) and European Control Conference (ECC)*, Orlando, Dec. 2011.
doi:10.1109/CDC.2011.6161465
- C12.** A. Halder, and R. Bhattacharya. Beyond Monte Carlo: A Computational Framework for Uncertainty Propagation in Planetary Entry, Descent and Landing. *AIAA Guidance, Navigation and Control Conference*, Toronto, Aug. 2010.
doi:10.2514/6.2010-8029
- C11.** S. Zhao, A. Halder, and T. Kalmár-Nagy. Leader-Follower Dynamics for Unicycles. *American Control Conference*, St. Louis, June 2009.
doi:10.1109/ACC.2009.5160706
- C10.** S. Zhao, A. Halder, and T. Kalmár-Nagy. Nonlinear Dynamics of Unicycles in Leader-Follower Formation. *8th MSU-UAB Conference on Differential Equations and Computational Simulations*, Mississippi State University, May 2009.
- C9.** T. Kalmár-Nagy, A. Halder, and S. Zhao. Delay Tuned Phase Locking in A Pair of Coupled Limit Cycle Oscillators. *6th International Conference on Mathematical Modeling*, Vienna, Feb. 2009.
- C8.** S. Chauhan, C. Patil, A. Halder, and M. Sinha. FLIER: A Novel Sensor Fusion Algorithm. *3rd IEEE International Conference on Industrial and Information Systems*, IIT Kharagpur, Dec. 2008.
doi:10.1109/ICIINFS.2008.4798459
- C7.** M. Sinha, A. Halder, R. Garhwal, N. S. Gopinath, and N. K. Malik. Lunar Satellite Observation Vector Construction using Non-rotating Origin and IAU2000A Precession-Nutation Model. *Conference on Advances in Space Science and Technology*, IIT Kharagpur, Jan. 2008.
- C6.** M. Sinha, A. Halder, R. Garhwal, A. K. Ghosh, N. S. Gopinath, and N. K. Malik. Lunar Gravity Field Modeling: A Critical Survey. *Conference on Advances in Space Science and Technology*, IIT Kharagpur, Jan. 2008.

- C5.** V. Agarwal, **A. Halder**, R. Garhwal, A. Gupta, S. Ghosh, S. Saxena, and M. Sinha. Inertial Characterization of Unmanned Aerial Vehicle AX-1. *4th International Conference on Theoretical, Applied, Computational and Experimental Mechanics*, IIT Kharagpur, Dec. 2007.
- C4.** **A. Halder**, S. Ghosh, and M. Sinha. Fuzzy Quadtree based Path Planner and Trajectory Smoother for A Low Cost Unmanned Aerial Vehicle. *3rd Indian International Conference on Artificial Intelligence*, Pune, Dec. 2007.
- C3.** R. Garhwal, **A. Halder**, and M. Sinha. Sensitivity Analysis using Neural Network for Estimating Aircraft Stability and Control Derivatives. *IEEE International Conference on Intelligent and Advanced Systems*, Kuala Lumpur, Nov. 2007.
doi:10.1109/ICIAS.2007.4658380
- C2.** R. Garhwal, **A. Halder**, and M. Sinha. An Adaptive Fuzzy State Noise Driven Extended Kalman filter for Real-time Orbit Determination. *58th International Astronautical Congress*, Hyderabad, Sep. 2007.
- C1.** S. Ghosh, **A. Halder**, and M. Sinha. Path Planning for A Fixed Wing Micro Air Vehicle in Fuzzy Quadtree Framework. *7th European Micro Air Vehicle Conference*, Toulouse, Sep. 2007.

PAPERS UNDER
REVIEW

- A. Halder**, and T.T. Georgiou. Gradient Flows in Filtering and Fisher-Rao Geometry.
- Z. Askarzadeh, R. Fu, **A. Halder**, Y. Chen, and T.T. Georgiou. Stability Theory in ℓ_1 for Nonlinear Markov Chains and Stochastic Models for Opinion Dynamics over Influence Networks.
- A. Halder**, X. Geng, F.A.C.C. Fontes, P.R. Kumar, and L. Xie. Optimal Power Consumption for Demand Response of Thermostatically Controlled Loads.
- K. Lee, **A. Halder**, and R. Bhattacharya. A New Framework for Mean Square Stability of Stochastic Jump Linear Systems via Optimal Transport.

POSTER
PRESENTATIONS

- P4.** “Control of Large Scale Cyberphysical Systems”. *IEEE CDC*, Las Vegas, NV, Dec. 12, 2016.
- P3.** “Boolean Microgrid: A Theory of Operation for the Load Serving Entity”. *NSF CPS PI Meeting*, Arlington, VA, Oct. 31–Nov. 1, 2016.
- P2.** “Boolean Microgrid”. *NSF CPS PI Meeting*, Arlington, VA, Nov. 16–17, 2015.
- P1.** “A Control System Framework for Privacy Preserving Demand Response of Thermal Inertial Loads”. *Winedale Workshop*, Round Top, TX, Oct. 9, 2015.

PROFESSIONAL
ACTIVITIES

Referee Service

Journal (33)

- *Automatica* (4)
- *ASME Journal on Dynamic Systems, Measurement and Control* (21)
- *IET Control Theory & Applications* (1)
- *IEEE Transactions on Power Systems* (2)
- *IEEE Transactions on Smart Grid* (3)
- *Proceedings of the Royal Society A* (1)
- *Advances in Space Research* (1)

Conference (37)

- *American Control Conference 2018 (3)*
- *IEEE Conference on Decision and Control 2017 (3)*
- *IEEE Power & Energy Society General Meeting 2017 (1)*
- *American Control Conference 2017 (1)*
- *IEEE Conference on Decision and Control 2016 (3)*
- *American Control Conference 2016 (3)*
- *American Control Conference 2015 (4)*
- *IEEE Multi-conference on Systems and Control 2014 (1)*
- *IEEE Conference on Decision and Control 2014 (1)*
- *American Control Conference 2014 (3)*
- *IEEE Conference on Decision and Control 2013 (1)*
- *American Control Conference 2013 (4)*
- *American Control Conference 2012 (2)*
- *ASME Dynamic Systems and Control Conference 2012 (1)*
- *IEEE Conference on Decision and Control 2011 (1)*
- *IEEE Conference on Robotics and Automation 2010 (2)*
- *American Control Conference 2009 (1)*
- *IEEE International Conference on Intelligent and Advanced Systems 2007 (2)*

Conference/Workshop Activities

- *Organizer (with P.R. Kumar and L. Xie), Invited Session: “Recent Advances in Control of Thermal Inertial Loads and DC Microgrid Stability”, American Control Conference 2017.*
- *Co-Chair, Session: “Modeling”, IEEE Conference on Decision and Control 2014.*

AWARDS

Research Awards

- Outstanding Doctoral Student Award
Department of Aerospace Engineering, Texas A&M University, 2014.
- Best Presentation in Session Award
Session: ‘Filtering’, American Control Conference, Washington, D.C., 2013.
- Best Thesis Award (Dual Degree)
Development of An Autonomous Reconfigurable UAV
Department of Aerospace Engineering, IIT Kharagpur, INDIA 2008.

Travel Awards

- IMA Travel Support Award
Workshop on Control at Large Scales: Energy Markets and Responsive Grids, IMA Thematic Year on Control Theory and its Applications, Minneapolis, 2016.
- IEEE Control Systems Society Student Travel Award
American Control Conference, Portland, 2014.
- IEEE Control Systems Society Student Travel Award
American Control Conference, Washington, D.C., 2013.
- IEEE Control Systems Society Student Travel Award
51st IEEE Conference on Decision and Control, Maui, 2012.

INVITED TALKS (EXCLUDING CONFERENCE TALKS)

- T11.** Second Annual Center for Research in Open Source Software (CROSS) Research Symposium, University of California Santa Cruz, CA, October 4, 2017.
- T10.** 32nd Southern California Control Workshop, Caltech, CA, April 21, 2017.

- T9.** Department of Aerospace Engineering, Mississippi State University, MS, April 13, 2017.
- T8.** Department of Mechanical and Aerospace Engineering, Syracuse University, NY, March 31, 2017.
- T7.** Department of Mechanical Engineering, University of Texas at Dallas, TX, March 20, 2017.
- T6.** Department of Applied Mathematics and Statistics, University of California Santa Cruz, CA, January 27, 2017.
- T5.** Converge Inc., Denver, CO, December 5, 2016.
- T4.** Workshop on Architecture and Economics of the Future Grid, Texas A&M University, College Station, TX, November 3, 2016.
- T3.** Electric Power and Power Electronics Institute Seminar, Department of Electrical and Computer Engineering, Texas A&M University, College Station, TX, October 26, 2015.
- T2.** Schlumberger-Doll Research Center, Cambridge, MA, July 8, 2014.
- T1.** Department of Mechanical and Aerospace Engineering, University of Florida, Gainesville, FL, May 15, 2012.

TEACHING
EXPERIENCE

University of California, Irvine, Irvine, California USA

Co-lecturer for MAE 295: Networks and Control

Spring 2017

- Delivered in-class lectures on dynamics and control of multi-agent systems over networks.

Texas A&M University, College Station, Texas USA

Teaching Assistant for AERO 320: Numerical Methods

Fall 2013

- Designed and graded homeworks and tests.
- Designed lab assignments and conducted lab sessions for implementing the numerical methods in C++.
- Held help sessions.
- Course material: abhishekhalder.org/Aero320Fall2013

Grader for ENGR 111: Foundations of Engineering

Fall 2009

- Graded weekly assignments on engineering mechanics and statistics.
- Held weekly help sessions.

Indian Institute of Technology Kharagpur, West Bengal INDIA

Instructor for AE21008: Introduction to Flight Vehicle Controls

Spring 2008

- Delivered in-class lectures on the basics of feedback control systems, block diagrams, dynamic system modeling and response, designing PID controller, root-locus design, frequency response design, state space design.

PROFESSIONAL
MEMBERSHIP

IEEE Control Systems Society