

Mac Schwager

Department of Aeronautics and Astronautics
Durand Room 266
496 Lomita Mall
Stanford, CA 94305-4035

Email: schwager@stanford.edu

Homepage: <http://www.stanford.edu/people/schwager/>

Phone: 1-650-497-3563

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Education

PhD, MIT, Mechanical Engineering, Sept 2009

MS, MIT, Mechanical Engineering, June 2005

BS, Stanford University, Mechanical Engineering, June 2000

Academic Appointments

Assistant Professor, Aeronautics and Astronautics, Stanford University, Sept 2015–present

Assistant Professor, Mechanical Engineering, Boston University, Jan 2012–June 2015

Secondary Appointment, Systems Engineering, Boston University, Oct 2012–June 2015

Previous Employment

Postdoctoral Researcher, General Robotics, Automation, Sensing, and Perception (GRASP) Lab,
University of Pennsylvania, Philadelphia, PA, Feb 2010–Dec 2011

Postdoctoral Researcher, Computer Science and Artificial Intelligence Lab (CSAIL), MIT, Cam-
bridge, MA, Sept 2009–Sept 2011

Automation Engineer, Applied Materials, Horsham, UK, and Santa Clara, CA, July 2000–Sept
2002

Research Interests

Control of multi-robot systems; Aerial robotic sensing networks; Environmental monitoring and
active sensing; Distributed algorithms for estimation, learning, and optimization; Distributed phe-
nomena in natural and engineered systems.

Honors & Awards

DARPA YFA Award, 2018

Google Faculty Research Award, 2018

IEEE Transactions on Robotics King-Sun Fu Memorial Best Paper Award, 2016

Best Paper Finalist, International Conference on Robotics and Automation (ICRA), 2016

Early Career Research Excellence Award, BU College of Engineering, 2015

NSF CAREER Award, 2014

Best Paper Finalist, International Conference on Robotics and Automation (ICRA), 2011

Best Paper Award, Conference on the Simulation of Adaptive Behavior (SAB), 2008

Best Paper Finalist, International Conference on Robotics and Automation (ICRA), 2008

Current Research Funding

Ford: “Last Mile Autonomy: Perception-Driven Collision Avoidance in UAV Delivery Swarms,”
Role: PI, Amount: \$334,269, 01/01/2018–12/31/2019.

NSF grant CMMI-1562335: “Collaborative Research: Compressive Robotic Sensing Systems: Gain-
ing Efficiency through Sparsity in Dynamic Sensing Environments,” Role: PI, Total Amount:
\$701,178, Stanford Amount: \$375,000, 04/01/2016–03/31/2019.

SAIL-Toyota Center for AI Research: “Safe Feedback Interactions in Human Autonomous Vehicle Systems,” Role: PI, Amount: \$2,482,982, 12/01/2015–11/30/2018.

NSF grant IIS-1350904: “CAREER: Controlling Ecologically Destructive Processes with a Network of Intelligent Robotic Agents,” Role: PI, Amount: \$493,436, 03/15/2014–02/28/2019.

ONR grant N00014-12-1-1000: “persistent Decentralized Online Tasks (pDOT): An Online Optimization Approach to Multi-Agent Persistent Monitoring in Uncertain Environments,” Role: co-PI, Total Amount: \$1,000,000, Stanford Amount: \$499,980, 09/30/2012–09/30/2017.

Prior Research Funding

NSF grant CNS-1330008: “CPS: Synergy: Data Driven Intelligent Controlled Sensing for Cyber Physical Systems,” Role: co-PI, Amount: \$998,503, 10/01/2013–09/30/2017.

NSF grant CNS-1330036: “CPS: Breakthrough: Collaborative Research: Cyber-Physical Manipulation (CPM): Locating, Manipulation, and Retrieving Large Objects with Large Populations of Robots,” Role: PI, Total Amount: \$499,977, BU Amount: \$236,917, 10/01/2013–09/30/2016.

U. Waterloo, International Research Partnership Grant: “Optimization and Routing for Future Urban Transportation Systems,” Role: co-PI, Amount: \$8,000, 08/01/2013–07/01/2014.

Invited Lectures

2017: “Multi-Robot Systems: Collaboration and Competition,” Bay Area Robotics Symposium (BARS), Berkeley, CA, Nov 2018 • “Ants Dont Use WiFi: Enabling Robotic Agents to Collaborate and Compete without a Communication Network,” UC Berkeley DREAM Seminar, Berkeley, CA, Oct 2017 • “Distributed Algorithms: Multi-Robot Pursuit and Manipulation,” *Invited Seminar*, University of Zurich, Jun 2017 • “Rapidly-Exploring Random Cycles,” *TRO Invited Session*, ICRA 2017, Singapore, May 2017 • “Distributed Robotic Systems: Algorithms for Morphing and Manipulation,” *Invited Seminar*, Space Systems Loral, Mountain View, CA, April 2017.

2016: “Multi-Robot Systems: Distributed Algorithms for a Distributed World,” *Bay Area Robotics Symposium (BARS)*, Stanford, Nov 2016 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Phenomena,” *SAIL-Toyota Center Seminar Series*, Stanford, Oct, 2016 • “Multi-Robot Systems: Monitoring and Controlling Large-Scale Phenomena,” *Center for Automotive Research at Stanford (CARS) Affiliates Webinar*, Stanford, May 2016 • “Multi-Robot Systems: Monitoring and Managing Large-Scale Environments,” *Aeronautics and Astronautics Department Affiliates Seminar*, Stanford, April 2016 • “Multi-Robot Systems: Monitoring and Controlling Large-Scale Phenomena,” *Platform Lab Seminar*, Stanford, April 2016.

2015: “Distributed and Collaborative Intelligent Systems: Large Heterogeneous Systems,” *Army Research Lab Workshop on Distributed and Collaborative Intelligent Systems*, ARL, Adelphi, MD, Dec 2015 • “Foundations of Intelligent Sensing, Acting, and Learning,” *DOD Future Directions Workshop*, U Pennsylvania, Oct 2015 • “Information Asymmetry from Relative Sensing in Multi-Robot Systems,” *Workshop on Taxonomies of Interconnected Systems: Asymmetric Interactions in Distributed Robotics*, ICRA, Seattle, May 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,” *Department of Aeronautics and Astronautics*, Stanford University, May 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,” *IRIM Seminar*, Georgia Tech, April 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,” *Department of Aeronautics and Astronautics*, U Washington, April 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,” *Aerospace and Mechanical Engineering*, University of Southern California (USC), Mar 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,”

- Mechanical and Aerospace Engineering*, UC San Diego, Mar 2015 • “Multi-Robot Systems for Monitoring and Controlling Large Scale Environments,” *Computer Science and Engineering*, UC San Diego, Mar 2015.
- 2014: “Controlling Groups of Robots with Unreliable Relative Sensing,” *Mechanical Engineering Department Seminar*, Tufts University, Oct 2014 • “Multi-Robot Control for Coverage, Sensing, and Surveillance: A Perspective on Multi-Robot Systems Research,” *Workshop on the future of multiple-robot research and its multiple identities*, IROS, Chicago, Sept 2014 • “Multi-Robot Systems: Monitoring and Controlling Large Scale Phenomena,” *Mechanical Engineering Visiting Committee*, BU, May 2014 • “Multi-Robot Systems: Monitoring and Controlling Large Scale Phenomena,” *Systems Engineering Visiting Committee*, BU, May 2014 • “Controlling Groups of Robots with Unreliable Relative Sensing,” *Computer Science Seminar*, University of Southern California (USC), April 2014 • “Controlling Groups of Robots with Unreliable Relative Sensing,” *Aeronautics and Astronautics Department Seminar*, Stanford University, April 2014 • “Monitoring a Dynamic Environment with a Group of Sensing Robots,” *Robotics Colloquium*, Worcester Polytechnic Institute (WPI), March 2014.
- 2013: “Multi-Robot Systems: Monitoring and Controlling Large-Scale Phenomena,” *College of Engineering Dean’s Advisory Board Meeting*, Boston University, October, 2013 • “Optimal Sensing of Dynamic Environments with Multiple Robots,” *ECE Department Seminar*, University of Waterloo, ON, Canada, Sept 2013 • “Vehicle Rebalancing via Auxiliary Drivers in Mobility-on-Demand Systems,” *Workshop on Vehicle Autonomy in Urban Transportation Systems*, International Conference on Robotics and Automation (ICRA), Karlsruhe, Germany, May 2013 • “persistent Decentralized Online Tasks (pDOT),” *ONR Science of Autonomy Meeting*, Office of Naval Research, Washington, DC, April 2013.
- 2012: “Multi-Robot Control for Active Estimation of Dynamic Environments,” *Mechanical Science and Engineering Department Seminar*, University of Illinois, Urbana-Champaign (UIUC), Dec 2012 • “Traffic vs. Multi-Robot Systems,” *Workshop on Autonomy for Urban Transportation*, National University of Singapore (NUS), Aug 2012 • “Information Driven Control for Multi-Robot Estimation in Hazardous Environments,” *Computer Science Colloquium*, University of Colorado, Boulder, Jan 2012
- 2011: *CISE Seminar*, Boston University, Oct 2011 • *Workshop on 3D Exploration, Mapping, and Surveillance with Aerial Robots*, Robotics: Science and Systems (RSS), Los Angeles, CA, July 2011 • Worcester Polytechnic Institute (WPI), April 2011 • *Mechanical Engineering Department Seminar*, Boston University, Mar 2011
- 2010: University of California, Berkeley, Nov 2010 • Australian Centre for Field Robotics (ACFR), University of Sydney, Jan 2010
- 2009: University of California, Berkeley, Dec 2009 • *Workshop on Micro Aerial Vehicles from Technologies to Commercialization: Ready or not ready?*, International Conference on Intelligent Robots and Systems (IROS), St. Louis, MO, Oct 2009 • German Aerospace Center (DLR), Oberpfaffenhofen, Germany, Sept 2009 • Northwestern University, July 2009 • Max Planck Institute for Biological Cybernetics, Tübingen, Germany, July 2009 • Harvard University, April 2009
- 2008: Eidgenössische Technische Hochschule (ETH) Zürich, Switzerland, July 2008 • University of California, Santa Barbara, May 2008
- 2007: University of Pennsylvania, June 2007 • *Workshop on Collective Behaviors Inspired by Biological and Biochemical Systems*, International Conference on Robotics and Automation (ICRA), Rome, Italy, April 2007
- 2006: University of California, Santa Barbara, Nov 2006
- 2005: *Workshop on Building Mixed Societies of Animals and Robots*, Les Treilles Foundation,

Tourtour, France, April 2005

Teaching

Multi-Robot Control, Comm., and Sensing (AA 277), Aero Astro Dept, Stanford, Winter 2018
 Advanced Feedback Control Design (AA 212), Aero Astro Dept, Stanford, Fall 2017
 State Est. and Filtering for Aerospace Systems (AA273), Aero-Astro Dept, Stanford, Spring 2017
 Multi-Robot Control, Comm., and Sensing (AA 277), Aero Astro Dept, Stanford, Winter 2017
 Advanced Feedback Control Design (AA 212), Aero Astro Dept, Stanford, Fall 2016
 State Est. and Filtering for Aerospace Systems (AA 273), Aero Astro Dept, Stanford, Spring 2016
 Multi-Robot Control, Comm., and Sensing (AA 277), Aero Astro Dept, Stanford, Winter 2016
 Engineering Mechanics II: Dynamics (ME 302), Mech Eng Dept, BU, Spring 2015
 Adaptive Control (ME/SE 704), Mech Eng Dept and Sys Eng Div, BU, Fall 2014
 Multi-Robot Control, Communication, and Sensing (ME 700B), Mech Eng Dept, BU, Spring 2014
 Dynamics and Control of Mechanical Systems (ME 404), Mech Eng Dept, BU, Fall 2013
 Vibration of Complex Mechanical Systems (ME 515), Mech Eng Dept, BU, Spring 2013
 Dynamics and Control of Mechanical Systems (ME 404), Mech Eng Dept, BU, Fall 2012
 Adaptive Control Study Group, GRASP Lab, University of Pennsylvania, Summer 2011
 Robotics (2.165), Guest Lecturer, Mech Eng Dept, MIT, Spring 2009

Publications

Journal Articles

- [1] E. Cristofalo, E. Montijano, and M. Schwager. Vision-based control for fast 3D reconstruction with an aerial robot. *IEEE Transactions on Control Systems Technology*, 2018. **Under Review.**
- [2] E. Cristofalo, B. Li, E. Montijano, and M. Schwager. Depth from focus (DfF): Extracting 3D scene structure from a variable focus lens for robotic perception and navigation. *IEEE Transactions on Robotics*, 2018. **Under Review.**
- [3] R. Spica, D. Falanga, E. Cristofalo, E. Montijano, D. Scaramuzza, and M. Schwager. A real-time game theoretic planner for autonomous two-player drone racing. *IEEE Transactions on Robotics*, 2018. **Under Review.**
- [4] K. Leahy and M. Schwager. Tracking a Markov target in a discrete environment with multiple sensors. *IEEE Transactions on Automatic Control*, 2017. **Under Review.**
- [5] D. Zhou and M. Schwager. Agile coordination and assistive collision avoidance for quadrotor swarms using virtual structures. *IEEE Transactions on Robotics*, 2017. **Conditionally Accepted.**
- [6] K. Leahy, E. Cristofalo, C.-I. Vasile, A. Jones, E. Montijano, M. Schwager, and C. Belta. Control in belief space with temporal logic specifications using vision-based localization. *International Journal of Robotics Research*, 2017. **Under Review.**
- [7] J. Alonso-Mora, E. Montijano, T. Naegeli, O. Hilliges, M. Schwager, and D. Rus. Distributed multi-robot formation control in dynamic environments. *Autonomous Robots*, 2017. **Under Review.**
- [8] A. Pierson and M. Schwager. Controlling non-cooperative herds with robotic herders. *IEEE Transactions on Robotics*, pages 1–9, 2017. Published Online, DOI: 10.1109/tro.2017.2776308.

- [9] M. Schwager, M. P. Vitus, S. Powers, D. Rus, and C. J. Tomlin. Robust adaptive coverage control for robotic sensor networks. *IEEE Transactions on Control of Network Systems*, 4:462–476, 2017.
- [10] D. Zhou, Z. Wang, and M. Schwager. Fast, on-line collision avoidance for dynamic vehicles using buffered voronoi cells. *IEEE Robotics and Automation Letters*, 2(2):1047–1054, 2017.
- [11] A. Pierson, Z. Wang, and M. Schwager. Intercepting rogue robots: An algorithm for capturing multiple evaders with multiple pursuers. *IEEE Robotics and Automation Letters*, 2(2):530–537, 2017.
- [12] C. I. Vasile, M. Schwager, and C. Belta. Translational and rotational invariance in networked dynamical systems. *IEEE Transactions on Control of Network Systems*, 2017. Published Online, DOI: 10.1109/tcns.2017.2648499.
- [13] A. Pierson, L. C. Figueiredo, L. C. A. Pimenta, and M. Schwager. Adapting to sensing and actuation variations in multi-robot coverage. *International Journal of Robotics Research*, 36(3):337–354, 2017.
- [14] K. Leahy, D. Zhou, C.-I. Vasile, K. Oikonomopoulos, M. Schwager, and C. Belta. Persistent surveillance for unmanned aerial vehicles subject to charging and temporal logic constraints. *Autonomous Robots*, 40:1363–1378, 2016.
- [15] Z. Wang and M. Schwager. Force-amplifying N-robot transport system (Force-ANTS) for cooperative planar manipulation without communication. *International Journal of Robotics Research*, 35(13):1564–1586, 2016.
- [16] X. Lan and M. Schwager. Rapidly-exploring random cycles: Persistent estimation of spatio-temporal fields with multiple sensing robots. *IEEE Transactions on Robotics*, 32(5):1230–1244, 2016. **TRO King-Sun Fu Memorial Best Paper Award.**
- [17] J. J. Yu, M. Schwager, and D. Rus. The correlated orienteering problem and its application to persistent monitoring tasks. *IEEE Transactions on Robotics*, 32(5):1106–1118, 2016.
- [18] R. Allen, M. Pavone, and M. Schwager. Flying smartphones: When portable computing sprouts wings. *IEEE Pervasive Computing*, 15(3):83–88, 2016.
- [19] E. Montijano, E. Cristofalo, D. Zhou, M. Schwager, and C. Sagues. Vision-based distributed formation control without an external positioning system. *IEEE Transactions on Robotics*, 32(2):339–351, 2016.
- [20] P. Dames, M. Schwager, D. Rus, and V. Kumar. Active magnetic anomaly detection using multiple micro aerial vehicles. *IEEE Robotics and Automation Letters (RA-L)*, 1(1):153–160, 2016.
- [21] P. Dames, D. Thakur, M. Schwager, and V. Kumar. Playing fetch with your robot. *IEEE Robotics and Automation Magazine*, 21(2):46–52, June 2014.
- [22] D. E. Soltero, M. Schwager, and D. Rus. Decentralized path planning for coverage tasks using gradient descent adaptive control. *International Journal of Robotics Research*, 33(3):401–425, March 2014.

- [23] B. J. Julian, M. Angermann, M. Schwager, and D. Rus. Distributed robotic sensor networks: An information-theoretic approach. *International Journal of Robotics Research*, 31(10):1134–1154, September 2012.
- [24] S. L. Smith, M. Schwager, and D. Rus. Persistent robotic tasks: Monitoring and sweeping in changing environments. *IEEE Transactions on Robotics*, 28(2):410–426, April 2012.
- [25] R. N. Smith, M. Schwager, S. L. Smith, B. H. Jones, D. Rus, and G. S. Sukhatme. Persistent ocean monitoring with underwater gliders: Adapting sampling resolution. *Journal of Field Robotics*, 28(5):714–741, September-October 2011.
- [26] M. Schwager, B. Julian, M. Angermann, and D. Rus. Eyes in the sky: Decentralized control for the deployment of robotic camera networks. *Proceedings of the IEEE*, 99(9):1541–1561, September 2011.
- [27] M. Schwager, D. Rus, and J. J. Slotine. Unifying geometric, probabilistic, and potential field approaches to multi-robot deployment. *International Journal of Robotics Research*, 30(3):371–383, March 2011.
- [28] M. Schwager, D. Rus, and J. J. Slotine. Decentralized, adaptive coverage control for networked robots. *International Journal of Robotics Research*, 28(3):357–375, March 2009.
- [29] M. Schwager, C. Detweiler, I. Vasilescu, D. M. Anderson, and D. Rus. Data-driven identification of group dynamics for motion prediction and control. *Journal of Field Robotics*, 25(6-7):305–324, June-July 2008.
- [30] M. Schwager, D. M. Anderson, Z. Butler, and D. Rus. Robust classification of animal tracking data. *Computers and Electronics in Agriculture*, 56(1):46–59, March 2007.

Conference Proceedings

- [1] A. Caccavale and M. Schwager. Wireframe mapping for resource-constrained robots. In *Proc. of the International Conference on Intelligent Robotics and Systems (IROS)*, Madrid, Spain, 2018. **Under Review.**
- [2] R. Haksar and M. Schwager. Distributed deep reinforcement learning for fighting forest fires with a network of aerial robots. In *Proc. of the International Conference on Intelligent Robotics and Systems (IROS)*, Madrid, Spain, 2018. **Under Review.**
- [3] R. Spica, D. Falanga, E. Cristofalo, D. Scaramuzza, and M. Schwager. A real-time game theoretic planner for autonomous two-player drone racing. In *Proc. of Robotics: Science and Systems*, 2018. **Under Review.**
- [4] H. Nishimura and M. Schwager. Active motion-based communication for robots with monocular vision. In *Proc. of the International Conference on Robotics and Automation (ICRA)*, Brisbane, Australia, 2018. **Accepted.**
- [5] P. Culbertson and M. Schwager. Decentralized adaptive control for collaborative manipulation. In *Proc. of the International Conference on Robotics and Automation (ICRA)*, Brisbane, Australia, 2018. **Accepted.**
- [6] Z. Wang, S. Singh, M. Pavone, and M. Schwager. Cooperative object transport in 3d with multiple quadrotors using no peer communication. In *Proc. of the International Conference on Robotics and Automation (ICRA)*, Brisbane, Australia, 2018. **Accepted.**

- [7] M. Wang, Z. Wang, S. Paudel, and M. Schwager. Safe distributed lane change maneuvers for multiple autonomous vehicles using buffered input cells. In *Proc. of the International Conference on Robotics and Automation (ICRA)*, Brisbane, Australia, 2018. **Accepted**.
- [8] T. Halsted and M. Schwager. Distributed multi-robot localization from acoustic pulses using euclidean distance geometry. In *Proc. of the International Conference on Multi-Agent and Multi-Robot Systems (MRS)*, pages 104–111, Los Angeles, CA, 2017.
- [9] N. Usevitch, Z. Hammond, S. Follmer, and M. Schwager. Linear actuator robots: Differential kinematics, controllability, and algorithms for locomotion and shape morphing. In *Proc. of the International Conference on Intelligent Robots and Systems (IROS 17)*, pages 5361–5367, Vancouver, Canada, 2017.
- [10] A. Caccavale and M. Schwager. A distributed algorithm for mapping the graphical structure of complex environments with a swarm of robots. In *Proc. of the International Conference on Robotics and Automation (ICRA)*, pages 1459–1466, Singapore, 2017.
- [11] X. Lan and M. Schwager. Learning a dynamical system model for a spatiotemporal field using a mobile sensing robot. In *Proc. of the American Control Conference*, pages 170–175, Seattle, WA, 2017.
- [12] D. Aksaray, A. Jones, Z. Kong, M. Schwager, and C. Belta. Q-learning for robust satisfaction of signal temporal logic specifications. In *Proc. of the IEEE Conference on Decision and Control (CDC 16)*, pages 6565–6570, Las Vegas, NV, Dec 2016.
- [13] C. I. Vasile, K. Leahy, E. Cristofalo, A. Jones, M. Schwager, and C. Belta. Control in belief space with temporal logic specifications. In *Proc. of the IEEE Conference on Decision and Control (CDC 16)*, pages 7419–7424, Las Vegas, NV, Dec 2016.
- [14] Z. Wang, G. Yang, X. Su, and M. Schwager. Oujabots: Omnidirectional robots for cooperative object transport with rotation control using no communication. In *Proc. of the International Conference on Distributed Autonomous Robotics Systems (DARS)*, London, UK, Nov 2016.
- [15] E. Cristofalo, K. Leahy, C.-I. Vasile, E. Montijano, M. Schwager, and C. Belta. Vision-based mobile sensing for GPS-deprived control with temporal logic specifications. In Dana Kulić, Yoshihiko Nakamura, Oussama Khatib, and Gentiane Venture, editors, *2016 Internatinoal Symposium on Experimental Robotics*, pages 525–537, Tokyo, Japan, Oct 2017. Springer International Publishing.
- [16] H. Ding, E. Cristofalo, J. Wang, D. Castañon, E. Montijano, V. Saligrama, and M. Schwager. A multi-resolution approach for discovery and 3D modeling of archaeological sites using satellite imagery and a UAV-borne camera. In *Proc. of the American Control Conference (ACC 16)*, pages 1359–1365, Boston, MA, July 2016.
- [17] K. Leahy and M. Schwager. Always choose second best: Tracking a moving target on a graph with a noisy binary sensor. In *Proc. of the European Control Conference (ECC 16)*, pages 1715–1721, Aalborg, Denmark, June 2016.
- [18] Z. Wang and M. Schwager. Kinematic multi-robot manipulation with no communication using force feedback. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 16)*, pages 427–432, Stockholm, Sweden, May 2016.

- [19] J. Alonso-Mora, E. Montijano, M. Schwager, and D. Rus. Distributed multi-robot navigation in formation among obstacles: A geometric and optimization approach with consensus. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 16)*, pages 5356–5363, Stockholm, Sweden, May 2016.
- [20] D. Zhou and M. Schwager. Assistive collision avoidance for quadrotor swarm teleoperation. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 16)*, pages 1249–1254, Stockholm, Sweden, May 2016.
- [21] A. Pierson, A. Ataei, I. C. Paschalidis, and M. Schwager. Cooperative multi-quadrotor pursuit of an evader in an environment with no-fly zones. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 16)*, pages 320–326, Stockholm, Sweden, May 2016. **Best Conference Paper Finalist.**
- [22] E. Montijano, E. Cristofalo, M. Schwager, and C. Sagues. Distributed formation control of non-holonomic robots without a global reference frame. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 16)*, pages 5248–5254, Stockholm, Sweden, May 2016.
- [23] K. Leahy, A. Jones, M. Schwager, and C. Belta. Distributed informative path planning under temporal logic constraints. In *Proc. of the IEEE Conference on Decision and Control (CDC 15)*, pages 6803–6808, Osaka, Japan, Dec 2015.
- [24] Z. Wang and M. Schwager. Multi-robot manipulation with no communication using only local measurements. In *Proc. of the IEEE Conference on Decision and Control (CDC 15)*, pages 380–385, Osaka, Japan, Dec 2015.
- [25] C.-I. Vasile, M. Schwager, and C. Belta. SE(N) invariance in networked systems. In *Proc. of the European Control Conference (ECC 15)*, pages 186–191, Linz, Austria, July 2015.
- [26] A. Jones, M. Schwager, and C. Belta. Information-guided persistent monitoring under temporal logic constraints. In *Proc. of the American Control Conference (ACC 15)*, pages 1911–1916, Chicago, IL, July 2015.
- [27] D. Zhou and M. Schwager. Virtual rigid bodies for coordinated agile maneuvering of teams of micro aerial vehicles. In *Proc. of the International Conference on Robotics and Automation (ICRA 15)*, pages 1737–1742, Seattle, WA, May 2015.
- [28] A. Pierson and M. Schwager. Bio-inspired non-cooperative multi-robot herding. In *Proc. of the International Conference on Robotics and Automation (ICRA 15)*, pages 1843–1849, Seattle, WA, May 2015.
- [29] A. Pierson, L. C. Figueiredo, L. C. A. Pimenta, and M. Schwager. Adapting to performance variations in multi-robot coverage. In *Proc. of the International Conference on Robotics and Automation (ICRA 15)*, pages 415–420, Seattle, WA, May 2015.
- [30] Golnaz Habibi, Zachary Kingston, Zijian Wang, Mac Schwager, and James McLurkin. Pipelined consensus for global state estimation in multi-agent systems. In *Proceedings of the 2015 International Conference on Autonomous Agents and Multiagent Systems, AAMAS '15*, pages 1315–1323, Richland, SC, 2015. International Foundation for Autonomous Agents and Multiagent Systems.

- [31] Zijian Wang and Mac Schwager. Multi-robot manipulation without communication. In Nak-Young Chong and Young-Jo Cho, editors, *Distributed Autonomous Robotic Systems: The 12th International Symposium*, pages 135–149, Tokyo, 2016. Springer Japan.
- [32] J. Yu, M. Schwager, and D. Rus. Correlated orienteering problem and its application to informative path planning for persistent monitoring tasks. In *Proc. of the International Conference on Intelligent Robots and Systems (IROS 14)*, pages 342–349, Chicago, IL, September 2014.
- [33] Kevin Leahy, Dingjiang Zhou, Cristian-Ioan Vasile, Konstantinos Oikonomopoulos, Mac Schwager, and Calin Belta. Provably correct persistent surveillance for unmanned aerial vehicles subject to charging constraints. In M. Ani Hsieh, Oussama Khatib, and Vijay Kumar, editors, *Experimental Robotics: The 14th International Symposium on Experimental Robotics*, pages 605–619, Cham, 2016. Springer International Publishing.
- [34] E. Montijano, D. Zhou, M. Schwager, and C. Sagues. Distributed formation control without a global reference frame. In *Proc. of the American Control Conference (ACC 14)*, pages 3862–3867, Portland, OR, June 2014.
- [35] X. Lan and M. Schwager. A variational approach to trajectory planning for persistent monitoring of spatiotemporal fields. In *Proc. of the American Control Conference (ACC 14)*, pages 5627–5632, Portland, OR, June 2014.
- [36] D. Zhou and M. Schwager. Vector field following for quadrotors using differential flatness. In *Proc. of the International Conference on Robotics and Automation (ICRA 14)*, pages 6567–6572, Hong Kong, PRC, June 2014.
- [37] Alyssa Pierson and Mac Schwager. Adaptive inter-robot trust for robust multi-robot sensor coverage. In Masayuki Inaba and Peter Corke, editors, *Robotics Research: The 16th International Symposium ISRR*, pages 167–183, Cham, 2016. Springer International Publishing.
- [38] A. Jones, M. Schwager, and C. Belta. Distribution temporal logic: Combining correctness with quality of estimation. In *Proc. of the IEEE Conference on Decision and Control (CDC 13)*, pages 4719–4724, Florence, Italy, December 2013.
- [39] S. L. Smith, M. Pavone, M. Schwager, E. Frazzoli, and D. Rus. Rebalancing the rebalancers: Optimally routing vehicles and drivers in mobility-on-demand systems. In *Proc. of the American Control Conference (ACC 13)*, pages 2362–2367, Washington, DC, June 2013.
- [40] X. Lan and M. Schwager. Planning periodic persistent monitoring trajectories for sensing robots in Gaussian random fields. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 13)*, pages 2407–2412, Karlsruhe, Germany, May 2013.
- [41] A. Jones, M. Schwager, and C. Belta. A receding horizon algorithm for informative path planning with temporal logic constraints. In *Proc. of the IEEE International Conference on Robotics and Automation (ICRA 13)*, pages 5004–5009, Karlsruhe, Germany, May 2013.
- [42] P. Dames, M. Schwager, V. Kumar, and D. Rus. A decentralized control policy for adaptive information gathering in hazardous environments. In *Proc. of the IEEE International Conference on Decision and Control (CDC 12)*, pages 2807–2813, Maui, HI, December 2012.
- [43] D. E. Soltero, M. Schwager, and D. Rus. Generating informative paths for persistent sensing in unknown environments. In *Proc. of the International Conference on Intelligent Robots and Systems (IROS 12)*, pages 2172–2179, Algarve, Portugal, October 2012.

- [44] Mac Schwager, Philip Dames, Daniela Rus, and Vijay Kumar. A multi-robot control policy for information gathering in the presence of unknown hazards. In Henrik I. Christensen and Oussama Khatib, editors, *Robotics Research : The 15th International Symposium ISRR*, pages 455–472, Cham, 2017. Springer International Publishing.
- [45] Mac Schwager, Michael P. Vitus, Daniela Rus, and Claire J. Tomlin. Robust adaptive coverage for robotic sensor networks. In Henrik I. Christensen and Oussama Khatib, editors, *Robotics Research : The 15th International Symposium ISRR*, pages 437–454, Cham, 2017. Springer International Publishing.
- [46] B. J. Julian, M. Angermann, M. Schwager, and D. Rus. A scalable information theoretic approach to distributed robot coordination. In *Proc. of the IEEE/RSJ Conference on Intelligent Robots and Systems (IROS 11)*, pages 5187–5194, San Francisco, CA, USA, September 2011.
- [47] M. Schwager, N. Michael, V. Kumar, and D. Rus. Time scales and stability in networked multi-robot systems. In *Proc. of the International Conference on Robotics and Automation (ICRA 11)*, pages 3855–3862, Shanghai, China, May 2011. **Best Conference Paper Finalist.**
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- [54] Brian J. Julian, Mac Schwager, Michael Angermann, and Daniela Rus. A location-based algorithm for multi-hopping state estimates within a distributed robot team. In Andrew Howard, Karl Iagnemma, and Alonzo Kelly, editors, *Field and Service Robotics: Results of the 7th International Conference*, pages 319–329, Berlin, Heidelberg, 2010. Springer Berlin Heidelberg.

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- [61] M. Schwager, J. J. Slotine, and D. Rus. Consensus learning for distributed coverage control. In *Proc. of the International Conference on Robotics and Automation (ICRA 08)*, pages 1042–1048, Pasadena, CA, May 19–23 2008. **Best Conference Paper Finalist.**
- [62] M. Schwager, F. Bullo, D. Skelly, and D. Rus. A ladybug exploration strategy for distributed adaptive coverage control. In *Proc. of the International Conference on Robotics and Automation (ICRA 08)*, pages 2346–2353, Pasadena, CA, May 19–23 2008.
- [63] M. Schwager, D. M. Anderson, and D. Rus. Data-driven identification of group dynamics for motion prediction and control. In C. Laugier and R. Siegwart, editors, *Field and Service Robotics: Results of the 6th International Conference*, volume 42 of *Springer Tracts in Advanced Robotics (STAR)*, pages 391–400, Berlin, 2008. Springer-Verlag.
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- [68] M. Schwager, A. M. Annaswamy, and E. Lavretsky. Adaptation based reconfiguration in the presence of actuator failures and saturation. In *Proc. of the American Control Conference (ACC 05)*, pages 2640–2645, Portland, Oregon, June 2005. **Best Presentation of Session.**

Theses

- [1] M. Schwager. *A Gradient Optimization Approach to Adaptive Multi-Robot Control*. Ph.D. Thesis, Massachusetts Institute of Technology, September 2009.
- [2] M. Schwager. *Towards Verifiable Adaptive Control for Safety Critical Applications*. M.S. Thesis, Massachusetts Institute of Technology, June 2005.

Professional Activities

Editorships

Associate Editor, IEEE Transactions on Robotics, since Feb 2017.

Guest Editor, International Journal of Robotics Research (IJRR) special issue on “3D Exploration, Mapping, and Surveillance,” 31(12), Oct 2012.

Conference Organizing

co-Chair, International Symposium on Distributed Autonomous Robotic Systems (DARS), Boulder, CO, Oct 2018.

Associate Editor, International Conference on Robotics and Automation (ICRA), Brisbane, Australia, May 2018.

Program Committee, Robotics: Science and Systems (RSS), Boston, MA, July 2017.

Associate Editor, International Conference on Robotics and Automation (ICRA), Singapore, May 2017.

Program Committee, International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN), San Francisco, CA Dec 2016.

Program Committee, Workshop on the Algorithmic Foundations of Robotics (WAFR), San Francisco, CA, Dec 2016.

Program Committee, Distributed Autonomous Robotic Systems (DARS), London, UK, Nov 2016.

Area Chair, Robotics: Science and Systems (RSS), Ann Arbor, MI, June 2016.

Associate Editor, International Conference on Robotics and Automation (ICRA), Helsinki, Sweden, May 2016.

Program Committee, Robotics Science and Systems (RSS), Rome, Italy, July 2015.

Associate Editor, International Conference on Robotics and Automation (ICRA), Seattle, WA, May 2015.

Best Paper Award Committee, International Symposium on Distributed Autonomous Robotic Systems (DARS), Daejeon, Korea, November 2014.

Program Committee, International Symposium on Distributed Autonomous Robotic Systems (DARS), Daejeon, Korea, November 2014.

Program Committee, International Symposium on Experimental Robotics (ISER), Marrakech, Morocco, June 2014.

Program Committee, Robotics: Science and Systems (RSS), Berkeley, CA, July 2014.

Associate Editor, International Conference on Robotics and Automation (ICRA), Hong Kong, PRC, May 2014.

Associate Editor, International Conference on Intelligent Robots and Systems (IROS), Tokyo, Japan, November 2013.

Program Committee, Robotics: Science and Systems (RSS), Berlin, Germany, June 2013.

Program Committee, Robotics: Science and Systems (RSS), Sydney, Australia, July 2012.

Program Committee, International Symposium on Experimental Robotics (ISER), Quebec City, Canada, June 2012.

Program Committee, International Symposium on Distributed Robotic Systems (DARS), Lausanne, Switzerland, November 2010.

Workshop and Invited Session Organizing

Co-organizer, Workshop “Multi-Robot Perception Driven Control and Planning,” International Conference on Robotics and Automation (ICRA), Singapore, Jun 2017.

Co-organizer, Workshop “Beyond Geometric Constraints: Planning for Solving Complex Tasks, Reducing Uncertainty, and Generating Informative Paths & Policies,” International Conference on Robotics and Automation (ICRA), Seattle, WA, May 2015.

Co-organizer, Workshop “On Robotic Exploration, Monitoring, and Information Collection: Non-parametric Modeling, Information-based Control, and Planning under Uncertainty,” Robotics: Science and Systems (RSS), Berlin, Germany, June 2013.

Co-organizer, Invited session “Persistent Monitoring,” IEEE Conference on Decision and Control (CDC), Maui, Hawaii, December 2012.

Co-organizer, Workshop on “Stochastic Motion Planning and Information Based Control,” Robotics: Science and Systems (RSS), Sydney, Australia, July 2012.

Co-organizer, Workshop on “3D Exploration, Mapping, and Surveillance with Aerial Robots,” Robotics: Science and Systems (RSS), Los Angeles, CA, June 2011.

Co-organizer, Workshop on “Network Science and Systems Issues in Multi-robot Autonomy,” International Conference on Robotics and Automation (ICRA), Anchorage, Alaska, May 2010.

Conference Session Chairs

Co-chair of the session “Distributed Robot Systems 1,” International Conference on Robotics and Automation (ICRA), Singapore, May 2017.

Co-chair of the session “Learning and Adaptive Systems II,” International Conference on Robotics and Automation (ICRA), Seattle, WA, May 2015.

Co-chair of the session “Control Theory and Design,” American Control Conference (ACC), Portland, OR, June 2014.

Co-chair of the session “Aerial Robotics,” International Conference on Intelligent Robots and Systems (IROS), San Francisco, CA, September 2011.

Chair of the session “Learning & Scene Estimation,” Conference on Field and Service Robotics (FSR), Chamonix, France, July 2007.

Grant Proposal Reviewing

NSF Panel, February 2017

NSF Panel, March 2016

External Reviewer, Singapore MIT Alliance for Research and Technology (SMART), March 2013

External Reviewer, ARISTEIA Research Programme (Greek research program), February 2013

NSF Panel, June 2012

NSF Panel, December 2011

Publication Reviewing

Journal Reviewer for:

Automatica • Autonomous Robots • IEEE Transactions on Automatic Control • IEEE Transactions on Automation Science and Engineering • IEEE Transactions on Control Systems Technology • IEEE Transactions on Mechatronics • IEEE Transactions on Neural Networks • IEEE Transactions on Robotics • IEEE Transactions on Systems Man and Cybernetics C • Intelligent Service Robotics • International Journal of Control, Automation, and Systems • International Journal of Robotics Research • International Journal of Robust and Nonlinear Control • Journal of Field Robotics • Journal of Guidance, Control, and Dynamics • Neural Computing and Applications • Proceedings of the IEEE • Robotica • Systems and Control Letters

Conference Reviewer for:

American Control Conference (ACC) • Conference on Swarm Intelligence (ANTS) • IEEE Conference on Decision and Control (CDC) • IEEE Multi-Conference on Systems and Control (MSC) • International Conference on Field and Service Robotics (FSR) • International Conference on Intelligent Robots and Systems (IROS) • International Conference on Robotics and Automation (ICRA) • International Federation on Automatic Control (IFAC) World Congress • International IFAC Symposium on Robot Control • International Symposium on Distributed Robotic Systems (DARS) • International Symposium on Experimental Robotics (ISER) • International Symposium on the Mathematical Theory of Networks and Systems (MTNS) • International Symposium of Robotics Research (ISRR) • Mediterranean Conference on Control and Automation (MED) • Workshop on the Algorithmic Foundations of Robotics (WAFR) • Robotics: Science and Systems (RSS)

Professional Memberships

IEEE Member (since 2004) • IEEE Control Systems Society (since 2004) • IEEE Robotics and Automation Society (since 2006)

University & Departmental Service

Hiring Committee, junior faculty search in robotics and cyber-physical systems, Mechanical Engineering, BU, Sept 2014–May 2015

Center for Information and Systems Engineering (CISE) Seminar Organizing Committee, Systems Engineering, BU, April 2014–June 2015

Website Committee, Mechanical Engineering, BU, Sept 2013–Aug 2014

Graduate Committee, Systems Engineering, BU, Sept 2012–Aug 2014

Graduate Committee, Mechanical Engineering, BU, Jan 2012–Aug 2013

Advising

Current PhD Students

Kunal Shah, Mechanical Engineering, Stanford, Sept 2017–Present

Trevor Halsted, Mechanical Engineering, Stanford, June 2017–Present

Mingyu Wang, Mechanical Engineering, Stanford, March 2017–Present

Preston Culbertson, Mechanical Engineering, Stanford, Jan 2017–Present
 Haruki Nishimura, Aeronautics and Astronautics, Stanford, Sept 2016–Present
 Adam Caccavale, Aeronautics and Astronautics, Stanford, Sept 2016–Present
 Nathan Usevitch, Mechanical Engineering, Stanford, Sept 2016–Present
 Ravi Haksar, Mechanical Engineering, Stanford, June 2016–Present
 Eric Cristofalo, Aeronautics and Astronautics, Stanford, June 2016–Present
 Zijian Wang, Aeronautics and Astronautics, Stanford, Mar 2016–Present

Former Postdocs

Dr. Riccardo Spica, Aeronautics and Astronautics, Stanford, Jan 2017–Jan 2018 (currently research engineer at MBDA Italia)
 Dr. Armin Ataei, Mechanical Engineering, BU, Feb 2015–Mar 2015 (currently at Symbotic)
 Dr. Jingjin Yu (co-advised), Mechanical Engineering, BU, July 2013–July 2014 (currently Asst. Prof. of CS, Rutgers)

Graduated PhD Students

Kevin Leahy (co-advised), Mechanical Engineering, BU, Jan 2014–Dec 2016 (currently research scientist at MIT-Lincoln Labs)
 Alyssa Pierson, Mechanical Engineering, BU, June 2012–Dec 2016 (currently postdoc at MIT CSAIL)
 Dingjiang Zhou, Mechanical Engineering, BU, June 2012–Dec 2016 (co-founder, Bito Robotics Inc.)
 Xiaodong Lan, Mechanical Engineering, BU, Jan 2012–Sept 2015 (currently research engineer at Amazon)
 Austin Jones (co-advised), Systems Engineering, BU, June 2012–April 2015 (currently research scientist at MIT-Lincoln Labs)

Graduated MS Students

Shreyasha Paudel, Aeronautics and Astronautics, Stanford, Sept 2014–Sept 2016 (currently at Ford Research and Innovation Center)
 Aamodh Suresh, Mechanical Engineering, BU, Jan 2015–May 2016 (currently a PhD student at UC San Diego)
 Christopher Becker, Mechanical Engineering, BU, Sept 2012–May 2013 (currently at the Volpe National Transportation Systems Center)

PhD Committees (reader, oral, or chair)

Brian Itcher, Aeronautics and Astronautics, Stanford, Mar 2018
 Brandon Fetroe, Mechanical Engineering, Stanford, Mar 2018
 Joey Greer, Mechanical Engineering, Stanford, Feb 2018
 Stefan Jorgensen, Electrical Engineering, Stanford, Feb 2018
 Federico Rossi, Aeronautics and Astronautics, Stanford, Jan 2018
 Spencer Clark, Chemistry, Stanford, Dec 2017 (chair)
 Ellen Klingbeil, Computer Science, Stanford, Jun 2017
 Niels Joubert, Computer Science, Stanford, Dec 2016 (chair)
 Kevin Leahy, Mechanical Engineering, BU, Dec 2016
 Alyssa Pierson, Mechanical Engineering, BU, Dec 2016
 Dingjiang Zhou, Mechanical Engineering, BU, Dec 2016
 Rick Zhang, Aeronautics and Astronautics, Stanford, May 2016
 Ross Allen, Aeronautics and Astronautics, Stanford, April 2016

Sarah Houts, Aeronautics and Astronautics, Stanford, Feb 2016
Xiaodong Lan, Mechanical Engineering, BU, Sept 2015
Philip Dames, Mechanical Engineering and Applied Mechanics, UPenn, June 2015
Benjamin Charrow, Mechanical Engineering and Applied Mechanics, UPenn, May 2015
Golnaz Habibi, Computer Science, Rice University, April 2015
Austin Jones, Systems Engineering, BU, April 2015
Kayhan Özcimder, Mechanical Engineering, BU, Dec 2014
Ana Medina Ayala, Mechanical Engineering, BU, Nov 2014
Jing Qian, Electrical and Computer Engineering, BU, Aug 2014 (chair)
Xuchao Lin, Systems Engineering, BU, May 2014
Igor Cizelj, Systems Engineering, BU, April 2014
Ebru Gol, Systems Engineering, BU, Feb 2014
Stephanie Gil, Aeronautics and Astronautics, MIT, Dec 2013
Brian Julian, Electrical Engineering and Computer Science, MIT, June 2013
Victor Kuo, Australian Centre for Field Robotics (ACFR), U Sydney, Australia, June 2013
Reno Wang, Systems Engineering, BU, Mar 2013
Eduardo Montijano, Informática e Ingeniería de Sistemas, U Zaragoza, Spain, Oct 2012

Prospectus Defense Committees

Dingjiang Zhou, Mechanical Engineering, BU, Mar 2016
Ben Chiel, Mechanical Engineering, BU, Jan 2016
Kevin Leahy, Mechanical Engineering, BU, Dec 2015
Alyssa Pierson, Mechanical Engineering, BU, Dec 2015
Benjamin Charrow, Mechanical Engineering and Applied Mechanics, UPenn, Jan 2015
Philip Dames, Mechanical Engineering and Applied Mechanics, UPenn, Jan 2015
Andrew Wixom, Mechanical Engineering, BU, Aug 2014
Julia Fleck, Systems Engineering, BU, May 2014
Austin Jones, Systems Engineering, BU, May 2014
Golnaz Habibi, Computer Science, Rice University, April 2014
Yasaman Khazaeni, Systems Engineering, BU, Mar 2014
Xiaodong Lan, Mechanical Engineering, BU, Jan 2014
Igor Cizelj, Systems Engineering, BU, Jan 2013
Alphan Ulusoy, Systems Engineering, BU, Nov 2012
Xuchao Lin, Systems Engineering, BU, July 2012
Ana Medina Ayala, Mechanical Engineering, BU, April 2012

References available upon request.