

David M. Rosen

CONTACT INFORMATION

MIT Computer Science and
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RESEARCH INTERESTS

Robotics, optimization, probabilistic inference, machine learning

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA USA

PhD candidate in EECS, concentration in robotics (expected graduation date: May 2016)
Minor concentration in Brain and Cognitive Science
Advisor: John J. Leonard

The University of Texas at Austin, Austin, TX USA

MA Mathematics, May 2010
Advisors: Raphael de la Llave, Alan Reid

California Institute of Technology, Pasadena, CA USA

BS Mathematics with Honors, June 2008
Advisors: David Wales, David Ben McReynolds
Minor in Control and Dynamical Systems
Advisors: Jerrold Marsden, Richard Murray, Joel Burdick

HONORS, AWARDS, FELLOWSHIPS

MIT Intelligence Initiative Fellowship	2011
MIT Energy Initiative Fellowship	2010 – 2011
UT Austin Topology Group NSF Research Training Grant Fellowship	2008 – 2009
Summer Undergraduate Research Fellowships (Caltech)	2005, 2006, 2007
Leon L. Granoff Merit Scholarship	2004 – 2008

RESEARCH AND EXPERIENCE

Massachusetts Institute of Technology, Cambridge, MA USA

Doctoral candidate, Marine Robotics Group **August 2010 – present**
My research interests lie at the intersection of mathematics, machine learning, and engineering, and are focused on the development of provably robust and computationally efficient online learning and inference methods. My interests span both the purely mathematical aspects of algorithm design (robustness, consistency, and convergence guarantees, etc.) as well as the more practical/computational aspects of their implementation (speed, numerical stability, etc.) I am particularly interested in the application of these techniques as an aid to robust long-duration robotic autonomy.

Google Research, Mountain View, CA USA

Software engineering intern **June 2014 – August 2014**
Designed and implemented robust mapping and localization systems to support persistent autonomous operation for teams of indoor ground robots.

The Applied Research Laboratories at UT Austin, Austin, TX USA

Graduate research assistant, Advanced Sonar Division **2009 – 2010**
Developed online and post-processed sonar-based image processing and computer vision algorithms for deployment on underwater autonomous vehicles.

California Institute of Technology, Pasadena, CA USA

Senior Thesis in Control and Dynamical Systems

2007 – 2008

Developed an improved laser scan-matching algorithm as an aid to more robust and computationally efficient implementations of simultaneous localization and mapping (SLAM) algorithms in three-dimensional urban environments.

Rose Hills Summer Undergraduate Research Fellowship

2007

Studied properties of arithmetic Fuchsian groups whose quotients of the hyperbolic plane are rational homology 2-spheres. Investigated a possible method of proof for resolving a conjecture of Long, Maclachlan and Reid regarding a maximal degree for the invariant trace fields associated to such groups.

Robert I. and Winifred Gardner Summer Undergraduate Research Fellowship

2006

Developed and implemented a particle filter-based traffic flow prediction algorithm for Caltech's DARPA Urban Challenge team to enable autonomous ground vehicles to safely navigate urban roadways.

Summer Undergraduate Research Fellowship

2005

Developed hierarchical path-planning algorithms for the Caltech DARPA Grand Challenge Team to enable an autonomous ground vehicle to navigate large desert environments.

TEACHING

Graduate student teaching assistant

Fall 2013

Served as one of three graduate student teaching assistants for the MIT Department of Electrical Engineering and Computer Science doctoral qualifying examination course in machine learning (EECS 6.867) taught in the Fall 2013 term by Prof. Tommi Jaakkola. Responsibilities included leading weekly recitation/tutorial sections, holding weekly office hours, and assisting in the composition and grading of weekly homeworks and the course midterm and final examinations.

PUBLICATIONS

Journal publications

- [1] David M. Rosen, Michael Kaess, and John J. Leonard. "RISE: An Incremental Trust-Region Method for Robust Online Sparse Least-Squares Estimation". In: *IEEE Transactions on Robotics* 30.5 (Oct. 2014), pp. 1091–1108.

Other peer-reviewed publications

- [2] David M. Rosen, Charles DuHadway, and John J. Leonard. "A Convex Relaxation for Approximate Global Optimization in Simultaneous Localization and Mapping". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Seattle, WA, May 2015 (to appear).
- [3] David M. Rosen, Guoquan Huang, and John J. Leonard. "Inference Over Heterogeneous Finite-/Infinite-Dimensional Systems Using Factor Graphs and Gaussian Processes". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Hong Kong, China, June 2014, pp. 1261–1268.
- [4] David M. Rosen, Michael Kaess, and John J. Leonard. "Robust Incremental Online Inference Over Sparse Factor Graphs: Beyond the Gaussian Case". In: *IEEE International Conference on Robotics and Automation (ICRA)*. Karlsruhe, Germany, May 2013, pp. 1017–1024.

- [5] David M. Rosen, Michael Kaess, and John J. Leonard. “An Incremental Trust-Region Method for Robust Online Sparse Least-Squares Estimation”. In: *IEEE International Conference on Robotics and Automation (ICRA)*. St. Paul, MN, May 2012, pp. 1262–1269.

SOFTWARE

I am a developer for MIT’s incremental smoothing and mapping (iSAM) library: <http://people.csail.mit.edu/kaess/isam/>

The RISE incremental trust-region optimization algorithm is implemented in MIT’s iSAM library and the Georgia Tech Smoothing and Mapping (GTSAM) library: <https://borg.cc.gatech.edu/projects/gtsam>

PROFESSIONAL
SERVICE

Journal reviewer

T-RO (IEEE Transactions on Robotics): 2014

Program committee member

RSS (Robotics: Science and Systems): 2015

Conference reviewer

RSS (Robotics: Science and Systems): 2014–2015

ICRA (International Conference on Robotics and Automation): 2015

IROS (International Conference on Intelligent Robots and Systems): 2012, 2014, 2015

RELATED
ACTIVITIES

Member, Product Design for the Developing World Field Test Team 2008

Traveled to Guatemala as part of a joint program between Caltech, the Pasadena Art Center College of Design, and Guatemala City’s Universidad Rafael Landivar to develop technologies and products to improve productivity and quality of life in the developing world. Designed, implemented, field-tested, and collected feedback on a proposed drip-irrigation system for improving the productivity and efficiency of small farms.

**Mapping Team Leader and founding member, Caltech RoboCup Rescue Team
2005 – 2007**

Managed a team of programmers developing algorithms to enable a search-and-rescue robot to autonomously map three-dimensional urban disaster environments.

Member, Caltech Robotics Outreach Group 2004 – 2008

Mentored high-schoolers in FIRST Robotics contest, organized seminars and community outreach presentations on robotics for the local community around Caltech. Served as President 2007 – 2008.