

JOHN J. LEONARD

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John J. Leonard is Samuel C. Collins Professor in the MIT Department of Mechanical Engineering and a member of the MIT Computer Science and Artificial Intelligence Laboratory. His research addresses the problems of navigation and mapping for autonomous mobile robots. Leonard was a pioneer in formulating the problem of Simultaneous Localization and Mapping (SLAM) in the mobile robotics research community. With his students and collaborators, he has developed several state-of-the-art robot navigation and mapping systems for robots operating in underwater and terrestrial environments. He has extensive experience deploying underwater robots systems for Navy missions such as mine-hunting and surveillance. He has lead several major initiatives for the Office of Naval Research, including a program to utilize SLAM for mine neutralization and a program for cooperative navigation of multiple autonomous underwater vehicles and gliders. He was team leader for MIT's DARPA Urban Challenge team, which was one of eleven teams to qualify for the Urban Challenge final event and one of six teams to complete the race.

Prof. Leonard served as Associate Department Head for Research in the MIT Department of Mechanical Engineering from 2013-2016. He has served as an associate editor of the IEEE Journal of Oceanic Engineering from 1998-2006 and of the IEEE Transactions on Robotics and Automation from 2000-2003. He was one of three guest editors for the 2008 IEEE Transactions on Robotics Special Issue on Visual SLAM. He was an Area Chair for Robotics: Science and systems in 2005, 2014 and 2015. He is an advisory board member of the University of Michigan Department of Naval Architecture and the Robotics: Science and Systems Foundation. He is the recipient of a Thouron Award (1987), an NSF Career Award (1998), a Science Foundation Ireland E.T.S. Walton Visitor Award (2004), the Best Paper Award at ACM SenSys in 2004 (shared with D. Moore, D. Rus, and S. Teller), and the King-Sun Fu Memorial Best Transactions on Robotics Paper Award in 2006 (shared with R. Eustice and H. Singh). He was a finalist for the Best Automation Paper Award at ICRA 2011, a finalist for the Best Paper Award for ICRA 2012, and a finalist for the Best Student Paper Award for ICRA 2013. He was elected an IEEE Fellow in 2014.

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Education:

D.Phil., University of Oxford 1994
B.S.E.E., University of Pennsylvania 1987

Selected MIT Appointments and Service:

Joined the MIT Faculty 1996
Associate Department Head for Research 2013-2016
Chair, MechE General Faculty Search Committee 2013-present
MIT Faculty Postdoc Advisory Committee 2013-2016
Area Head, Ocean Science and Engineering 2008-2014
Faculty Director, Ford-MIT Alliance 2009-2013
MIT/Woods Hole Joint Committee for Applied Ocean Science and Engineering 2009-present
Sea Grant College Program Committee 2008-present
MIT Museum Advisory Board 2006-2012
Chair, Faculty Search Committee for Ocean Engineering 2010-2011
MIT/Woods Hole Joint Program Strategic Planning Committee 2010-2011
ME/OE Merger Review Committee 2009-2010
Area Head, Control, Instrumentation and Robotics 2007-2008
Chair, Faculty Search Committee for Robotics 2007-2008
Chair, Faculty Search Committee for Ocean Engineering 2006-2007
ME Strategic Planning Committee 2004-2005
Department ABET Coordinator 2000-2002

Selected Honors and Awards:

General Motors Scholarship 1985
A. Atwater Kent Award, Moore School of Electrical Engineering, U. of Penn. 1987
Thouron Fellowship 1987-1989
Henry L. and Grace Doherty Assistant Professorship in Ocean Utilization 1996-1998
National Science Foundation CAREER Award 1998
E.T.S. Walton Visitor Award, Science Foundation Ireland 2004
Best Paper Award, ACM SenSys 2004 2004
Best Student Paper Award, IEEE ICRA 2005 2005
King-Sun Fu Memorial Best Transactions on Robotics Paper Award 2007
Honorary Professor, Dept. of Computer Science, National University of Ireland, Maynooth 2008

Selected External Service:

Advisory Board, Robotics: Science and Systems 2009-2015
Advisory Board, Department of Naval Architecture, University of Michigan 2011-present
Guest Associate Editor, IEEE Trans. on Robotics, Special Issue on Visual SLAM 2007-2008

Associate Editor, IEEE Journal of Oceanic Engineering
Area Chair, Robotics: Science and Systems
Associate Editor, IEEE Transactions on Robotics and Automation

1998-2006
2005, 2014, 2015
2000-2003

Publications of John J. Leonard

Professor Leonard, together with his research group and collaborators, has published one book, 40 refereed journal articles and over 100 conference papers. Professor Leonard has mentored 27 S.M students, 5 Engineer's degree students, 24 Ph.D. students, and 9 postdoctoral associates, and he has served on 44 Ph.D. committees. A list of his publications is provided below in chronological order:

- [1] C. Brown, H. Durrant-Whyte, J. Leonard, and B. Rao. Centralized and decentralized Kalman filter techniques for tracking, navigation, and control. In *DARPA Image Understanding Workshop*, pages 651–675, May 1989.
- [2] H. F. Durrant-Whyte and J. J. Leonard. Navigation by correlating geometric sensor data. In *Proc. IEEE Int. Workshop on Intelligent Robots and Systems*, 1989.
- [3] J. J. Leonard and H. F. Durrant-Whyte. Active sensor control for mobile robotics. In *IARP Int. Conf. on Multi-Sensor Fusion and Environment Modelling*, Toulouse, France, October 1989.
- [4] M. Brady, H. Durrant-Whyte, H. Hu, J. Leonard, P. Probert, and B. Rao. Sensor-based control of AGV's. In *IARP 1st Workshop on Domestic Robots and 2nd Workshop on Medical and Healthcare Robotics*, September 1989. Also published in *Int. Workshop on Sensorial Integration for Industrial Robots*, Zaragoza, Spain, November, 1989, and *IEE Computing and Control Journal*, March 1990.
- [5] J. J. Leonard, I. J. Cox, and H. F. Durrant-Whyte. Dynamic map building for an autonomous mobile robot. In *Proc. IEEE Int. Workshop on Intelligent Robots and Systems*, pages 89–96, 1990. Also published in *Autonomous Mobile Robots*, edited by S. Iyengar and A. Elfes, Los Alamitos, CA: IEEE Computer Society Press 1991.
- [6] J. J. Leonard and H. F. Durrant-Whyte. Application of multi-target tracking to sonar-based mobile robot navigation. In *29th IEEE Int. Conference on Decision and Control*, 1990.
- [7] J. J. Leonard. Sonar interpretation using regions of constant depth (rcds). In *IEE Colloquium on Robot Sensors*, pages 1/1–1/4. IET, 1991.
- [8] I. J. Cox and J. J. Leonard. Temporal integration of multiple sensor observations for dynamic world modeling: A multiple hypothesis approach. In *International Workshop on Information Processing for Autonomous Mobile Robots: Theory and Application*, Munich, Germany, 1991. Berlin: Springer-Verlag.
- [9] I. J. Cox and J. J. Leonard. Probabilistic data association for dynamic world modeling: A multiple hypothesis approach. In *International Conference on Advanced Robotics*, Pisa, Italy, 1991.

- [10] J. J. Leonard and H. F. Durrant-Whyte. Mobile robot localization by tracking geometric beacons. *IEEE Trans. Robotics and Automation*, 7(3):376–382, June 1991.
- [11] J. J. Leonard and H. F. Durrant-Whyte. Simultaneous map building and localization for an autonomous mobile robot. In *Proc. IEEE Int. Workshop on Intelligent Robots and Systems*, pages 1442–1447, Osaka, Japan, 1991.
- [12] J. J. Leonard and H. F. Durrant-Whyte. *Directed Sonar Sensing for Mobile Robot Navigation*. Boston: Kluwer Academic Publishers, 1992.
- [13] J. J. Leonard, I. J. Cox, and H. F. Durrant-Whyte. Dynamic map building for an autonomous mobile robot. *The International Journal of Robotics Research*, 11(4):286–298, August 1992.
- [14] C. Brown, H. Durrant-Whyte, J. Leonard, B. Rao, and B. Steer. Distributed data fusion using Kalman filtering: A robotics application. In M. A. Abidi and R. C. Gonzalez, editors, *Data Fusion in Robotics and Machine Intelligence*, pages 267–309. Academic Press, 1992.
- [15] H. F. Durrant-Whyte and J. J. Leonard. Modeling sonar sensors. In *The Robotics Review II*, pages 145–151. MIT Press, 1992.
- [16] J. J. Leonard and B. A. Moran. Sonar data fusion for 3-D scene reconstruction. In Paul S. Schenker, editor, *SPIE Sensor Fusion V*, pages 144–155, Boston, MA, November 1992.
- [17] J. J. Leonard and J. G. Bellingham. Directed sensing strategies for feature-relative navigation. In Paul S. Schenker, editor, *SPIE Sensor Fusion VI*, pages 120–129, Boston, MA, September 1993.
- [18] B. A. Moran, J. J. Leonard, and C. Chryssostomidis. Geometric shape from sonar ranging. In *Proc. Int. Symp. on Unmanned Untethered Submersible Technology*, pages 370–383, 1993.
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- [20] J. G. Bellingham, C. Chryssostomidis, M. Deffenbaugh, J. J. Leonard, and H. Schmidt. Arctic under-ice survey operations. In *Proc. Int. Symp. on Unmanned Untethered Submersible Technology*, pages 50–59, 1993.
- [21] I. Cox and J. Leonard. Modeling a dynamic environment using a Bayesian multiple hypothesis approach. *Artificial Intelligence*, pages 311–344, April 1994.
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- [23] J. Bellingham, C. Goudey, T. Consi, J. Bales, D. Atwood, J.J. Leonard, and C. Chryssostomidis. Odyssey II: A second generation survey AUV. In *IEEE Symposium on Autonomous Underwater Vehicle Technology*, Cambridge, MA, 1994.
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