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 the MIT Department of Mechanical Engineering as Associate Department Head for Research from 2013-2016 and he is currently Associate Department Head for Education. He also currently serves as an Associate Director for Engineering for the MIT/WHOI Joint Program. 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. He served on the Robotics: Science and Systems Foundation Board from 2005 to 2015. 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), the King-Sun Fu Memorial Best Transactions on Robotics Paper Award in 2006 (shared with R. Eustice and H. Singh) and the WAFR 2016 Best Paper Award (shared with D. Rosen, L. Carlone, and A. F. Bandeira). 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 and an AAAS Fellow in 2019.

Professor Leonard is a Technical Advisor for Human Interactive Driving at Toyota Research Institute.

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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 Education	2023-present
Member, Subcommittee on the Communication Requirement	2023-present
Chair, Department Head Search Committee	2023
Member, Distinguished Fellowships Committee	2022-present
Dean's Action Group, Social and Ethical Responsibilities of Computing	2020-2021
Member, MIT Task Force on Work of the Future	2018-2020
Chair, MechE Faculty Awards Committee	2019-present
Member, SoE Faculty Awards Committee	2019-present
Co-Chair, MechE General Faculty Search Committee	2018-2021
Associate Director, MIT/Woods Hole Joint Program	2018-present
Associate Department Head for Research	2013-2016
Chair, MechE General Faculty Search Committee	2013-2017
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	2008-2015
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
Finisher, DARPA Urban Challenge	2007
Honorary Professor, Dept. of Computer Science, National University of Ireland, Maynooth	2008
Finalist, Best Automation Paper Award, IEEE ICRA	2011
Finalist, Best Paper Award, IEEE ICRA	2012
Finalist, Best Student Paper Award, IEEE ICRA	2013
Best Paper Award, Workshop on Algorithmic Foundations of Robotics	2016

Selected External Service:

Advisory Board, Department of Naval Architecture, University of Michigan	2011-present
Associate Editor, IEEE ICRA	2022-present
Area Chair, Robotics: Science and Systems	2005, 2014, 2015
Advisory Board, Robotics: Science and Systems	2009-2015
Guest Associate Editor, IEEE Trans. on Robotics, Special Issue on Visual SLAM	2007-2008
Associate Editor, IEEE Journal of Oceanic Engineering	1998-2006
Associate Editor, IEEE Transactions on Robotics and Automation	2000-2003

Publications of John J. Leonard

Professor Leonard, together with his research group and collaborators, has published over 260 papers. Professor Leonard has mentored 15 M.Eng. students, 39 S.M students, 6 Engineer's degree students, 36 Ph.D. students, and 15 postdoctoral fellows, and he has served on 92 Ph.D. committees. He is a co-inventer for 14 patents. 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. Fl. Durrant-Whyte. Mobile robot localization by tracking geometric beacons. *IEEE Trans. Robotics and Automation*, 7(3):376–382, June 1991.

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[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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[21] I. Cox and J. Leonard. Modeling a dynamic environment using a Bayesian multiple hypothesis approach. *Artificial Intelligence*, pages 311–344, April 1994.

[22] J. G. Bellingham and J. J. Leonard. Task configuration with layered control. In *Proceedings of the IARP 2nd Workshop on Mobile Robots for Subsea Environments*, pages 193–302, Monterey, CA, USA, May 1994.

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[29] J. J. Leonard, S. T. Tuohy, J. G. Bellingham, B. A. Moran, J. H. Kim, H. Schmidt, N. M. Patrikalakis, and C. Chryssostomidis. Virtual environments for AUV development and ocean exploration. In *Proc. Int. Symp. on Unmanned Untethered Submersible Technology*, pages 436–443, September 1995.

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