

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Mechanical Engineering

Ramanarayan Vasudevan, assistant professor of mechanical engineering, Department of Mechanical Engineering, College of Engineering, is recommended for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, College of Engineering.

Academic Degrees:

- Ph.D. 2012 University of California, Electrical Engineering and Computer Sciences, Berkeley, CA
M.S. 2009 University of California, Electrical Engineering and Computer Sciences, Berkeley, CA
B.S. 2006 University of California, Electrical Engineering and Computer Sciences, Berkeley, CA

Professional Record:

- 2015 – present Assistant Professor, Department of Mechanical Engineering, University of Michigan
2015 – 2017 Assistant Research Professor, Transportation Institute, University of Michigan
2002 – 2014 Post-doctoral Associate, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, MA

Summary of Evaluation:

Teaching: Professor Vasudevan is an innovative, effective, and committed educator, advisor, and mentor and a previous recipient of the ME Faculty Achievement award, which recognizes excellence in teaching. He has taught four different courses in nine different semesters at UM including co-developing ME 599: Self-Driving Cars. He is the primary advisor for eleven Ph.D. students and is co-advising seven other Ph.D. students. He has graduated five Ph.D. students including one who is now a faculty member and another two pursuing post-doctoral studies. Professor Vasudevan has also advised several M.S. students and undergraduate students. He demonstrates a consistent ethic of publishing with his students as primary authors and is especially proud of his record of publishing with undergraduate students. Student's praise Professor Vasudevan for his passion, commitment, encouraging environment and impact on their career paths.

Research: Professor Vasudevan's research focuses on dynamical systems, control and optimization with application to automated vehicles, robotics and human posture control. His work has been published in the premier control and robotics journals and resulted in three best paper awards and an additional best paper finalist at the premier control and robotics conferences and has an h-index of 21 and an i10-index of 42 according to Google Scholar. He is considered a rising leader in his field, who is internationally recognized for making significant contributions

to robotics research. His NSF Career Award and ONR Young Investigator Award are indicators of Professor Vasudevan's innovativeness, intellect, and commitment.

Professor Vasudevan's research focus is on the development of optimization theory and algorithms to enable the accurate, real-time, and safe operation of robotic systems acting in complex environments with and around humans. Specific examples of algorithms he has developed include a planning method for autonomous systems that guarantees safe operation without sacrificing real-time performance, a modeling and control technique for soft robotic systems that resulted in the first fully autonomous soft robot capable of precision pick and place tasks, and the first procedure that was verified to compute the region of attraction of human movement and was capable of predicting failure during the performance of a biomechanical task. Professor Vasudevan's work has been licensed by several companies including Ford Motor Company who is applying his algorithm to perform autonomous lane change maneuvers in their next generation vehicle fleet.

Recent and Significant Publications:

- Patrick Holmes, Shreyas Kousik, Bohao Zhang, Daphna Raz, Corina Baarbalata, Matthew Johnson-Roberson, Ram Vasudevan, "Reachable Sets for Safe, Real-Time Manipulator Trajectory Design," *Robotics: Science and Systems*, 2002.01591 (2020).
- Pengcheng Zhao, Shakar Mohan, Ram Vasudevan, "Optimal control of polynomial hybrid systems via convex relaxations," *IEEE Transactions on Automatic Control*, 65.5 (2019): 2062-2077.
- Patrick Holmes, Shannon Danforth, Xiao-Yu Fu, Talia Moore, Ram Vasudevan, "Characterizing the limits of human stability during motion: perturbative experiment validates a model-based approach for the Sit-to-Stand task," *Royal Society Open Science*, 7.1 (2020): 191410.
- Joshua Mangelson, Ryan Eustice, Ram Vasudevan, "Pairwise consistent measurement set maximization for robust multi-robot map merging," 2018 *IEEE International Conference on Robotics and Automation (ICRA)*, 2018.
- Bruder, Daniel, et al, "Modeling and control of soft robots using the koopman operator and model predictive control," *Robotics: Science and Systems*, 1902.02827 (2019).

Service: Professor Vasudevan has an excellent service record within the Department of Mechanical Engineering (ME), the Robotics Institute, and scientific community. He is currently serving on the ME Graduate Admissions Committee, and has served on the ME Seminar Committee (as a member and as a chair), the UMTRI Simulator Committee, and ME Junior Faculty Lunch Committee. At the college level, he has served as DEI Faculty Ally and Graduate Program Committee for the Robotics Institute, the Autonomy Pillar Lead for the Automotive Research Center, and member of the Program Committee for ISD Automotive Engineering Program. Professor Vasudevan has served his scientific community well having co-organized five workshops and conferences and as a reviewer for several organizations including *Nature: Machine Intelligence*, *National Research Foundation of Korea*, *Science: Robotics*, *IEEE Transactions on Vehicular Technology*, *IEEE Robotics and Automation Letters*, *International Journal of Robotics Research*, to name a few. He is serving as an associate editor of *IEEE Robotics and Automation Society* and the *IFAC Mechatronics* journal. His K-12 outreach is notable through participation with First Robotics, ID Day at Michigan's Museum of Natural

History, Research Education and Activities for Classroom Teachers, and the Summer College Engineering Exposure Program that aims to reach female middle and high school students and students from diverse socioeconomic backgrounds.

External Reviewers:

Reviewer A: “Strong evidence that his work is having impact and appreciated by the research community is his growing list of outstanding paper awards at well-known conferences; this is impressive.”

Reviewer B: “...Ram is a star, has already achieved a great deal, and is going to be a major player in robotics for years to come.”

Reviewer C: “Professor Vasudevan is a well established researcher on highest international level... I view him among the top five researchers in USA in comparison to other scholars in his field at the same stage of their career.”

Reviewer D: “His work has placed him at the forefront of robotics and cyberphysical systems- his international visibility is already high and will only increase with time.”

Reviewer E: “His record of service to the university and to his professional community exceeds what I have typically seen for faculty at his career stage.... I fully expect him to become a leader of his generation of robotic researchers...”

Reviewer F: “He is not only a rising star in his field, but he is also bringing a rare, unique, and in my personal opinion, particularly useful set of technical skills to a mechanical engineering department.”

Summary of Recommendation: Professor Vasudevan is a very prominent, dedicated, and ambitious teacher, advisor, and mentor, who is making significant impact with his research. It is with the support of the College of Engineering Executive Committee that I recommend Ramanarayan Vasudevan for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, College of Engineering.



Alec D. Gallimore, Ph.D.
Robert J. Vlasic Dean of Engineering
College of Engineering

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