

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

Karthik Duraisamy, associate professor of aerospace engineering, with tenure, Department of Aerospace Engineering, College of Engineering, is recommended for promotion to professor of aerospace engineering, with tenure, Department of Aerospace Engineering, College of Engineering.

Academic Degrees:

Ph.D.	2005	University of Maryland, Aerospace Engineering, College Park, MD
M.S.	2005	University of Maryland, Aerospace Engineering, College Park, MD
M.S.	2000	Indian Institute of Science, Aerospace Engineering, Bengaluru, India
B.E.	1998	Coimbatore Institute of Technology, Mechanical Engineering, Coimbatore, India

Professional Record:

2017 – present	Associate Professor (with tenure), Department of Aerospace Engineering, University of Michigan
2013 – 2017	Assistant Professor, Department of Aerospace Engineering, University of Michigan
2009 – 2013	Consulting Assistant Professor, Department of Aeronautics and Astronautics, Stanford University, Stanford, CA
2007 – 2009	Lecturer, Aerospace Engineering, University of Glasgow, Cambridge, MA
2005 – 2006	Assistant Research Scientist, Department of Aerospace Engineering, College Park, MD

Summary of Evaluation:

Teaching: Professor Duraisamy has established himself as an innovative, challenging, and caring teacher. He has been active in curriculum development at the graduate level and has taught two undergraduate courses. His teaching evaluations have been uniformly strong, with most of his Q1 and Q2 scores in the 4.7 – 5.0 range. The student letters that the committee collected, from undergraduate and graduate students, were universally positive. Consistent themes were Professor Duraisamy’s passion for what he teaches, and his willingness to go above and beyond in helping students. He has graduated seven Ph.D. students as the chair and four as co-chair. He is advising or co-advising another 14 Ph.D. students with four expected to graduate this year. He is also a member of several other Ph.D. committees. In addition, he is active in advising M.S. and undergraduate students, as well as mentoring post-doctoral scholars.

Research: Professor Duraisamy has established himself as a leader in combining physics-based modeling with machine learning. His work in data-driven turbulence modeling, reduced-order models for rocket combustion, data-driven modeling of multi-scale physical phenomena, and physics-constrained numerical methods is highly visible, and well respected by his peers. Professor Duraisamy has published over 60 articles in refereed journals and two articles in highly

selective computer science conferences. He also has several publications under review. He is in high demand as a speaker and has given more than 50 invited talks including two keynote addresses and one plenary. His funding is from a wide array of federal and industrial sources, totaling \$32 million, with his share more than \$10 million. He has formed a substantial number of research collaborations, at Michigan and elsewhere. Professor Duraisamy's work has been recognized with the College of Engineering's Miller Faculty Scholarship (2019) and a research excellence award (2016). He was selected as an associate fellow of the American Institute of Aeronautics and Astronautics in 2020.

#### Recent and Significant Publications:

- Duraisamy, K., "Perspectives on Machine Learning-augmented Reynolds-averaged and Large Eddy Simulation Models of Turbulence," *Physical Review Fluids*, 2021.
- Huang, C., Wentland, C., Duraisamy, K., Merkle, C., "Model Reduction for Multi-scale Transport Problems using Model-form-Preserving Least Squares Projections with Variable Transformation," *Journal of Computational Physics*, 2021.
- Pan, S., Duraisamy, K., "Physics-Informed Probabilistic Learning of Linear Embeddings of Non-linear Dynamics with Guaranteed Stability," *SIAM Journal on Applied Dynamical Systems*, 2020.
- Pan, S., Duraisamy, K., "On the Structure of Time-delay Embedding in Linear Models of Non-linear Dynamical Systems," *Chaos*, 2020.
- Parish, E., Duraisamy, K., "A Paradigm for Data-driven Predictive Modeling Using Field Inversion and Machine Learning," *Journal of Computational Physics*, 2016; 305: 16.

Service: Professor Duraisamy is active in his service roles at all levels. At the department level, he has made contributions to administration, planning, climate, and outreach. He has been active in mentoring junior faculty. At the college and university level, he has served as an associate director of MICDE, on the steering committee of MIDAS, and on the University's IT Council. At the professional level, he is an associate editor of *Progress in Aerospace Sciences*, and is active with the AIAA, AFOSR, and NASA.

#### External Reviewers:

Reviewer A: "Karthik...is an internationally-known contributor to the field of data-enabled turbulence modeling, model reduction, and nonlinear system discretization and modeling...I fully and completely support his promotion to full professor."

Reviewer B: "It is clear that Prof. Duraisamy is well on his way to establish himself in a small and select group of world leaders in (data-driven techniques in computational fluid dynamics and turbulence closures)."

Reviewer C: "Prof. Duraisamy is an absolute gem and Michigan is extremely lucky to have him. He is a world-class talent and leading figure in aerospace engineering, especially in data-driven and machine learning modeling efforts where he has many pioneering contributions."

Reviewer D: "It is true to say that Karthik has been one of the pioneers in (data-driven turbulence modeling and reduced order modeling)...it is my assessment that the consideration of

Karthik Duraisamy for the rank of Full Professor at the University of Michigan should be a straightforward process. I give the promotion case my strongest support.”

Reviewer E: “He has already established himself as one of the leading thinkers in an emerging field, prolific author, excellent fundraiser, willing to serve his institution and community, and successful educator.”

Summary of Recommendation: Professor Duraisamy has excelled in research, teaching, and service. He is recognized by his colleagues at Michigan and beyond, and his students, as an outstanding member of the faculty of the Department of Aerospace Engineering. It is with the support of the College of Engineering Executive Committee that I recommend Karthik Duraisamy for promotion to professor of aerospace engineering, with tenure, Department of Aerospace Engineering, College of Engineering.



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

May 2022