

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Naval Architecture and Marine Engineering

Kevin J. Maki, associate professor of naval architecture and marine engineering, with tenure, Department of Naval Architecture and Marine Engineering, College of Engineering, is recommended for promotion to professor of naval architecture and marine engineering, with tenure, Department of Naval Architecture and Marine Engineering, College of Engineering.

Academic Degrees:

Ph.D.	2005	University of Michigan, Naval Architecture and Marine Engineering, Ann Arbor, MI
M.S.	2004	University of Michigan, Aerospace Engineering, Ann Arbor, MI
M.S.	2002	University of Michigan, Naval Architecture and Marine Engineering, Ann Arbor, MI
B.S.E.	2001	University of Michigan, Naval Architecture and Marine Engineering, Ann Arbor, MI

Professional Record:

2020 – present	Director of the Aaron Friedman Hydrodynamics Laboratory, Naval Architecture and Marine Engineering, University of Michigan
2017 – present	Associate Professor (with tenure), Department of Naval Architecture and Marine Engineering, University of Michigan
2011 – 2017	Assistant Professor, Department of Naval Architecture and Marine Engineering, University of Michigan
2007 – 2011	Assistant Research Scientist and Lecturer, Department of Naval Architecture and Marine Engineering, University of Michigan
2006 – 2007	Research Fellow and Adjunct Lecturer, Department of Naval Architecture and Marine Engineering, University of Michigan

Summary of Evaluation:

Teaching: Professor Maki is a versatile, reliable, and successful classroom instructor, and a conscientious mentor and advisor. His instructional versatility is evident from having taught 11 distinct NAME courses (270, 320, 321, 401, 403, 423, 440, 499, 492, 599, 620) since 2006. His instructional reliability is indicated by his average Q1 and Q2 teaching-evaluation scores, 4.6 and 4.8 (out of 5.0), respectively, for his time in rank. He has consulted with CRLT Engin to ensure that he provides an inclusive learning experience to students, and his instructional success is apparent from his teaching evaluation scores and student commentary. He is also a fine research advisor and mentor. He has graduated 15 Ph.D. students as chair or co-chair and has an additional six students in progress. He has also advised several masters and undergraduate students and post-doctoral scholars.

Research: Predicting and quantifying the forces and motions associated with ships maneuvering on the ocean surface is one of the marquee priorities of naval architecture and is known as

seakeeping analysis. Professor Maki's research work has advanced the use of computational fluid dynamics (CFD) for nonlinear seakeeping analysis. His research accomplishments include (1) the development of a state-of-the-art CFD solver based the OpenFOAM software platform that is suitable for ships maneuvering in waves, and (2) the development and adoption of machine learning techniques that leverage expensive time-domain CFD simulations for exploration of extreme hydrodynamic events and the robust quantification of their occurrence probability. Professor Maki is an internationally recognized leader in modern computational seakeeping analysis. He has a strong publication record with over 50 journal publications and over 90 refereed conference papers. He has over \$9M in funding.

Recent and Significant Publications:

- He, P., Mader, C.A., Martins, J.R. and Maki, K.J., 2018, "An aerodynamic design optimization framework using a discrete adjoint approach with OpenFOAM," *Computers & Fluids*, 168, pp.285-303.
- Silva, K.M. and Maki, K.J., 2021, "Towards a computational fluid dynamics implementation of the critical wave groups method," *Ocean Engineering*, 235, p.109451.
- Silva, K.M. and Maki, K.J., 2022, "Data-Driven system identification of 6-DoF ship motion in waves with neural networks," *Applied Ocean Research*, 125, p.103222.
- Xu, W., Filip, G. and Maki, K.J., 2020, "A method for the prediction of extreme ship responses using design-event theory and computational fluid dynamics," *Journal of Ship Research*, 64(01), pp.48-60.
- Zhang, Z., Han, T., Yoo, K.H., Capecehatro, J., Boehman, A.L. and Maki, K., 2021, "Disease transmission through expiratory aerosols on an urban bus," *Physics of Fluids*, 33(1), p.015116.

Service: Professor Maki is a well-known and well-regarded member of the marine hydrodynamics community, and his record of service is likewise impressive. He serves as an International Towing Tank Conference Committee chair, and as the founding chair of the OpenFOAM Marine-Applications Special Interest Group. He is a member of NATO's Applied Vehicle Technology (AVT)-348 Assessment of Experiments and Prediction Methods for Naval Ships Maneuvering in Waves; he has taken on leadership roles in organizing and hosting workshops and conferences, such as the International Workshop on Water Waves and Floating Bodies; and he serves on the editorial board of the *Journal of Engineering for the Maritime Environment*. At the University of Michigan, beyond his contributions to ADVANCE and NextProf, he serves on the college Safety Committee, and on department committees. Perhaps most importantly, Professor Maki serves as the Marine Hydrodynamics Laboratory (MHL) director. The MHL receives 500 to 1,000 visitors annually and Professor Maki has been NAME's primary outreach ambassador to local schools that serve underrepresented communities, pre-college summer students who are often learning about engineering for the first time, and myriad visitors of all types, from foreign dignitaries to US government and military officials.

External Reviewers:

Reviewer A: "...Dr. Maki's ability to build on past theories to create hybrid new methods shows a rare attention to profound theoretical understanding mixed with a good creativity spirit, demonstrated for instance in the case of accelerated CFD solver of steady (wavy) flow around ships, using linearized free surface boundary condition or the velocity decomposition methods."

Reviewer B: "Professor Maki is an expert in Naval Hydrodynamics, in particular the challenging area of ship maneuvering in complex wave fields. In a rapidly expanding series of publications he has made significant contributions to this field by integrating computational fluid mechanics and state of the art data analysis tools such as neural networks, machine learning, adjoint based optimization, and reduced order modeling into simpler probabilistic models that characterize the wave field and predict the ship response."

Reviewer C: "At the conferences, he gave many impressive presentations, particularly about the computational fluid dynamics related to ship hydrodynamics. Now he is one of the most active researchers in the ship hydrodynamics field."

Reviewer D: "...he is successful with projects, he always finds support for his PhD students, he is good at working with industry, he publishes his results in top journals, he is great in teaching, outreach, and innovation. On top of this, he is [a] high-level expert in CFD, which can make him a super star in many...universities."

Reviewer E: "...Dr. Maki and his students have lowered the barrier for adjoint implementations by using an object-oriented framework (DAFoam) to rapidly implement the discrete adjoint method for any steady state OpenFOAM primal solver by adding or modifying only a few hundred lines of source code. This is a significant accomplishment and will have broad impact."

Summary of Recommendation: Professor Maki's contributions have strengthened and expanded computational fluid dynamics for ships operating in the ocean. He is a dedicated, agile, and successful instructor and research mentor. He is a known and respected member of the marine hydrodynamics community. It is with the support of the College of Engineering Executive Committee that I recommend Kevin J. Maki for promotion to professor of naval architecture and marine engineering, with tenure, Department of Naval Architecture and Marine Engineering, College of Engineering.



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

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