PROMOTION RECOMMENDATION
The University of Michigan
College of Literature, Science, and the Arts

Shravan K. Veerapaneni, associate professor of mathematics, with tenure, College of Literature, Science, and the Arts, is recommended for promotion to professor of mathematics, with tenure, College of Literature, Science, and the Arts.

<u>Academic Degrees</u>:
Ph.D.   2008   University of Pennsylvania
B.Technology   2003   Indian Institute of Technology, Madras

<u>Professional Record</u>:
2017–present   Associate Professor, Department of Mathematics, University of Michigan
2011–2017   Assistant Professor, Department of Mathematics, University of Michigan
2008–2011   Research Scientist, Courant Institute of Mathematical Sciences, New York University

<u>Summary of Evaluation</u>:
<u>Teaching</u>: Professor Veerapaneni is a major contributor to the Department of Mathematics' teaching of numerical analysis. This area is in high demand from students, and relatively few faculty are qualified to teach it. As a result, Professor Veerapaneni's classroom teaching since his 2017 promotion has been concentrated in numerical analysis courses ranging from undergraduate to advanced graduate level. Students' median responses for the "excellent instructor" question of the teaching evaluation questionnaire are strong, ranging from 4.33 to 4.75 (on a scale of 1 to 5), with all but one being 4.5 or higher. Professor Veerapaneni has designed a new course on fast algorithms and PDE-constrained optimization; he is also working on developing courses in quantum information science. Since his last promotion, he has graduated two Ph.D. students and four post-doctoral scholars and is currently supervising six graduate students, three post-doctoral scholars, and four REU students.

<u>Research</u>: Professor Veerapaneni conducts research in applied mathematics and scientific computing. His research is motivated by applications in biology (e.g., elasticity/fluid dynamics of red blood cells) and chemical engineering (e.g., complex fluids, colloids). He also considers electrically conducting fluids with variable dielectric properties and situations in which the fluid viscosity jumps between two values across an interface. He is an expert in this interdisciplinary domain. His work displays deep understanding of the mathematical properties of the relevant equations and the physical mechanisms they represent, combined with creativity in designing effective solution algorithms. He implements the algorithms in computer codes and carries out large-scale simulations on high performance computing systems. External reviewers make it clear that Professor Veerapaneni is regarded as a world expert in his field. He has obtained research funding from numerous sources, including a National Science Foundation CAREER grant, a Simons Foundation Collaboration Grant, and grants from the U.S. Army.

Recent and Significant Publications:
Guo, H., Zhu, H. and Veerapaneni, S. (2020). Simulating cilia-driven mixing and transport in complex geometries. *Physical Review Fluids*, *5*(5), https://doi.org/10.1103/PhysRevFluids.5.053103

Bonnet, M., Liu, R., and Veerapaneni, S. (2020). Shape optimization of Stokesian peristaltic pumps using boundary integral methods. *Advances in Computational Mathematics*, *46*(2), https://doi.org/10.1007/s10444-020-09761-7

De, S., Corona, E., Jayakumar, P., and Veerapaneni, S. (2019). Scalable Solvers for Cone Complementarity Problems in Frictional Multibody Dynamics. *Proceedings of the IEEE High Performance Extreme Computing Conference, USA*, https://doi.org/10.1109/HPEC.2019.8916234

Wu, B., and Veerapaneni, S. (2019). Electrohydrodynamics of deflated vesicles: budding rheology and pairwise interactions. *Journal of Fluid Mechanics*, *861,* 334-347.

Service: Since his last promotion, Professor Veerapaneni has served continuously on the Department of Mathematics' Applied and Interdisciplinary (AIM) program's Graduate Admissions and Fellowships Committee. He also served for a year on the AIM Qualifying Exam Committee and more recently on the department's Website Committee. He has worked in administration and recruitment for our undergraduate research program, and he has served on the Education Committee of the Michigan Institute for Computational Discovery and Engineering. He served on the university's Quantum Computing Task Force. He has organized a symposium, a workshop, and several mini-symposia. He has refereed papers for numerous journals and has served on seven National Science Foundation review panels in his eight years at Michigan. He has worked with the U.S. Army on the possibility of joint post-doctoral positions, resulting in Army funding for a two-year post-doctoral position.

External Reviewers:
Reviewer (A): "Veerapaneni is a leading researcher in numerical methods based on singular and nearly singular integrals, especially in fluid flow in biological contexts. He maintains a high standard of quality. His areas of work have broadened significantly since he became an associate professor, as shown by the variety of problems and techniques."

Reviewer (B): "He is a world expert in boundary integral methods for viscous fluid flows…"

Reviewer (C): "…Shravan is a superb computational scientist who is now a national leader in numerical analysis, with a particular expertise in fluid-structure interactions, heat flow, viscous flow, and shape optimization. He is very productive, has excellent taste, is enthusiastic and personable, and builds important interactions between mathematics, engineering, and biophysics."

Reviewer (D): "He has done excellent work that has had a substantial impact on scientific computing … Dr. Veerapaneni has since 2007 published just over 30 papers. These have consistently appeared in top journals such as *Physics Review Letters, PNAS, SIAM Journal of*
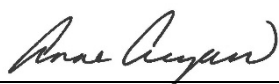
Scientific Computing, Journal of Computational Physics, etc. I am familiar with many of these papers, and consider them to be of very high quality … One aspect of his file that is particularly compelling is the upwards trajectory in recent years…"

Reviewer (E): "In summary, Shravan Veerapaneni is a leader in boundary integral methods who continues to make significant methodological advances, which in turn, allows his group to pursue important scientific goals in applications."

Reviewer (F): "In brief, I consider Prof. Veerapaneni to be one of the world's leading experts in the field of numerical modeling and scientific computing applied to viscous flows, particulate suspensions, complex fluids and soft matter … In my opinion, Prof. Veerapaneni has established himself as a top faculty member and scientist in the area of applied mathematics and scientific computation for viscous flows and complex fluids."

Summary of Recommendation:
Professor Veerapaneni has a very active, broad, and highly respected research program in applied mathematics and scientific computing. His computational innovations are being used by other researchers and his models are being applied in real-world situations. He teaches very well, contributes to the development of new courses at the frontiers of his fields, and mentors post-doctoral scholars, graduate students, and undergraduates. He has established a cooperative arrangement with the U.S. Army, and he has performed a great deal of important service work in our department. The Executive Committee of the College of Literature, Science, and the Arts and I recommend that Associate Professor Shravan K. Veerapaneni be promoted to the rank of professor of mathematics, with tenure, College of Literature Science, and the Arts.

Anne Curzan, Dean
Geneva Smitherman Collegiate Professor of
English Language and Literature, Linguistics,
and Education
Arthur F. Thurnau Professor
College of Literature, Science, and the Arts

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