



Semi-sesquicentennial of mecheng @ IISc

Distinguished Seminar Series



From Beating Hearts to Buzzing Wings: Flow Physics and Computation at the Intersection of Mechanics and Bioengineering

Prof. Rajat Mittal

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May 12, 2021 at 6:30 PM IST

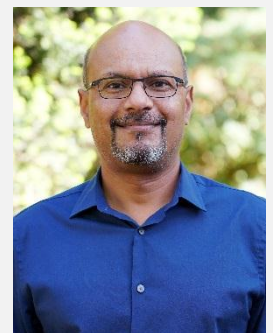
Meeting link: <https://bit.ly/3u6mlcG> (MS Teams)

ABSTRACT

The unceasing growth in computational power and the development of new software tools and numerical algorithms is opening up exciting areas of research, discovery & translation in mechanics and biomedical engineering. Consider the mammalian heart, which has been sculpted by millions of years of evolution into a flow pump par excellence. During the typical lifetime of a human, the heart will beat over three billion times and pump enough blood to fill over sixty Olympic-sized swimming pools. Each of these billions of cardiac cycles is itself a manifestation of a complex and elegant interplay between several distinct physical domains including electrophysiology, muscle mechanics, hemodynamics, flow-induced valves dynamics, acoustics, and biochemistry. Computational models provide the ability to explore such multi-physics problems with unprecedented fidelity and precision. In my talk, I will describe several projects that demonstrate the application of powerful computational tools to problems ranging from chemo-fluidics of clot formation to fluid-structure interaction in prosthetic heart valves. The talk will culminate with a brief discussion on a new project where we are using computational aeroacoustics to analyze wing-tone based communication in mosquitoes.

ABOUT THE SPEAKER

Rajat Mittal is Professor of Mechanical Engineering at the Johns Hopkins University with a secondary appointment in the School of Medicine. He received the B. Tech. degree from the Indian Institute of Technology at Kanpur in 1989, and the Ph.D. degree in Applied Mechanics from The University of Illinois at Urbana-Champaign, in 1995. His research interests include computational fluid dynamics, biomedical engineering, biological fluid dynamics, fluid-structure interaction and flow control. He has published over 200 technical articles on these topics and holds multiple patents in associated technologies. He is the recipient



of the 1996 Francois Frenkiel Award from the Division of Fluid Dynamics of the American Physical Society, and the 2006 Lewis Moody as well as 2021 Freeman Scholar Awards from the American Society of Mechanical Engineers (ASME). He is a Fellow of ASME and the American Physical Society, and an Associate Fellow of the American Institute of Aeronautics and Astronautics. He is an associate editor of the Journal of Computational Physics, Frontiers of Computational Physiology and Medicine, the Journal of Experimental Biology, and the International Journal for Numerical Methods in Biomedical Engineering.

Session chair: Prof. Jaywant H. Arakeri, mecheng @ IISc