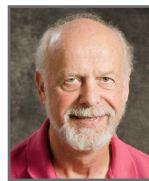




Wallace Lecture

Mechanical Engineering Lecture in Ocean Science and Engineering

Fast and efficient underwater propulsion inspired by biology



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Biology offers a rich source of inspiration for the design of novel propulsors with the potential to overcome and surpass the performance of traditional propulsors for the next generation of underwater vehicles. To-date, however, we have not achieved the deeper understanding of the biological systems required to engineer propulsors with the high speed and efficiency of animals like sailfish, tuna, or dolphins. What is the underlying physics of the fluid-structure interaction of bio-propulsors that results in the superior performance observed in nature? Moreover, how do we replicate this performance in the next generation of man-made propulsors? Can we push beyond the limits of biology? By studying the performance of simple heaving and pitching foils, we have identified the basic scaling that describes the thrust, power and efficiency, under continuous as well as burst-coast actuation. These scaling relationships allow us to identify the natural limits on simple bio-inspired propulsors, and suggest that further improvements in performance will require adaptive flexibility and optimized planforms.

Dr. Smits is the Eugene Higgins Professor of Mechanical and Aerospace Engineering at Princeton. His research interests are centered on fundamental, experimental research in turbulence and fluid mechanics. In 2004, Dr. Smits received the Fluid Dynamics Award of the American Institute of Aeronautics and Astronautics (AIAA). In 2007, he received the Fluids Engineering Award from the American Society of Mechanical Engineers (ASME), the Pendray Aerospace Literature Award from the AIAA, and the President's Award for Distinguished Teaching from Princeton University. In 2014, he received the Aerodynamic Measurement Technology Award from the AIAA. He is a Fellow of the American Physical Society, the American Institute of Aeronautics and Astronautics, the American Society of Mechanical Engineers, the American Academy for the Advancement of Science, the Australasian Fluid Mechanics Society, and he is a Member of the National Academy of Engineering. He is currently the Editor-in-Chief of the AIAA Journal.

The annual Wallace lecture program has been made possible by a gift from Mr. and Mrs. A. H. Chatfield, in honor of Mrs. Chatfield's father, Robert Bruce Wallace, MIT 1898. As president of the American Ship Building Company, Mr. Wallace made major contributions to develop inland waterway shipping. This generous gift provides funding for the Robert Bruce Wallace Academic Prize and the Lecture Series. The academic prize consists of a stipend and a year's full tuition at MIT awarded to a student in the Area of Ocean Science & Engineering in the Department of Mechanical Engineering who has shown excellence in scholarship in Ocean Engineering and leadership in student affairs. The Lecture Series is presented by an eminent figure in the marine community.