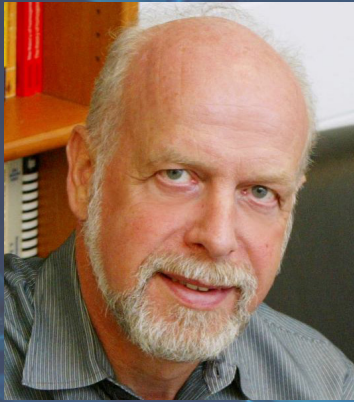


# AES Distinguished Speaker Series



# Alexander Smits

**Eugene Higgins Professor of Mechanical and  
Aerospace Engineering at Princeton University**

## Fast and Efficient Underwater Propulsion Inspired by Biology

**Friday, October 6, 2017 | DLC | 12:00 P.M.**

**Abstract:** Biology offers a rich source of inspiration for the design of novel propulsors with potential to 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 and tuna. What are the underlying physics of the fluid-structure interaction that results in the superior performance observed in nature? Moreover, how do we replicate this in 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 natural limits on simple bio-inspired propulsors, and suggest further performance improvements will require adaptive flexibility and optimized planforms.

**Bio:** Dr. Smits' research is centered on fundamental, experimental research in turbulence and fluid mechanics. He has been recognized by the American Institute of Aeronautics and Astronautics (AIAA) with their Fluid Dynamics Award, Pendray Aerospace Literature Award, and Aerodynamic Measurement Technology Award. Smits has also received the Fluids Engineering Award from the American Society of Mechanical Engineers (ASME) and the President's Award for Distinguished Teaching from Princeton. He is a Fellow of AIAA, ASME, the American Physical Society, the American Academy for the Advancement of Science, the Australasian Fluid Mechanics Society, and is a Member of the National Academy of Engineering. He is currently Editor-in-Chief of the AIAA Journal.