STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

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The flowfield and thrust performance of a biologically-inspired propulsor

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Autonomous underwater vehicles (AUV's) are becoming increasingly important in the roles of ocean sampling and surveillance, and great potential exists for their use in a variety of other applications. Their effectiveness could be enhanced through improvements in efficiency, stealth, and maneuverability, which we may realize by imitating the swimming characteristics of aquatic animals. This seminar explores the physics of thrust production through experimental investigation of the thrust performance and wake structure produced by a simple propulsor consisting of a rigid rectangular pitching panel. In particular, the characteristics of low-aspect-ratio panels will be discussed, which bear a resemblance to many types of biological fins. The parameters governing thrust performance will be investigated and a comprehensive vortex skeleton wake model will be presented. In spite of the disparate wake patterns observed with variation in forcing parameters, it is shown that each of these patterns is described by a single wake topology, which is consistent with structures observed in a wide variety of unsteady flows.

Dr. James Buchholz is a Research Specialist at Virtualwind Inc, and is involved in the development of computational fluid dynamics software to simulate wind flow in complex urban environments. He received his Ph.D. in Mechanical and Aerospace Engineering (2006) from Princeton University, where he investigated the physics of biologically-inspired underwater propulsion and was awarded the Association of Princeton Graduate Alumni Excellence in Teaching Award and the Crocco Teaching Prize. Prior to his Ph.D. studies, he led a program for the development of medical devices within the University of Calgary undergraduate engineering design curriculum while employed by TENET Medical Engineering Inc. in Calgary, Canada.

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