JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Weekly CEAFM Seminar: Fall 2013

Date: **Friday, September 27, 2013**

Time: 11:00 AM

Location: Gilman 50 (Marjorie M. Fisher Room)

Speaker: **Dr. Karen A. Flack** (United States Naval Academy, MD)

Title: ***"Performance Characteristics of a Model Marine Current Turbine"***

Abstract

Scale model tests were conducted on a two bladed horizontal axis marine current turbine in a large tow tank facility at the United States Naval Academy. Performance characteristics are presented for a 1/25th scale model operating in calm conditions and in the presence of intermediate and deep water waves. The power and thrust coefficients without waves match expected results from blade-element-momentum theory. The oscillatory wave velocity present in the water column results in significant variations in measured turbine torque and rotational speed as a function of wave phase. This in turn produces cyclic variations in tip speed ratio and power coefficient. The power coefficient over the entire wave phase did not show a difference from the experiments without waves for a range of tip speed ratios. The waves limited the lower range of tip speed ratios at which the turbine could operate. These results highlight the impact of surface waves on turbine design and performance, and the importance of understanding the site-specific wave conditions. Preliminary results on turbine wake velocity fields will also be presented.

Bio

Dr. Karen A. Flack is a professor of Mechanical Engineering at the United States Naval Academy in Annapolis, Maryland. She received a bachelor's degree from Rice University, a master's degree from the University of California, Berkeley and a Ph.D. from Stanford University, all in Mechanical Engineering. Professor Flack teaches courses in thermodynamics, fluid mechanics, heat transfer, as well as wind and tidal power. Her research focuses on turbulent boundary layer physics with a concentration on rough wall boundary layers and frictional drag prediction. Recent work also includes performance characteristics of tidal turbines in unsteady flow conditions. She is secretary/treasurer of the American Physics Society, Division of Fluid Dynamics and on the editorial board of the International Journal of Heat and Fluid Flow. She is the recipient of the ASME award for best paper in the Journal of Fluids Engineering, a Pi Tau Sigma teaching award, the Naval Academy Research award and United States government meritorious service medals.