

Weekly CEA FM Seminar: Spring 2018



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Date: **Friday, February 16, 2018**
Time: 3:00 PM
Location: Gilman Hall # 132
Speaker: **Prof. Megan Leftwich** (George Washington University)
Title: ***"The Wake Structures of Rotating Airfoils"***

Abstract

The wake structure of a vertical-axis wind turbine (VAWT) is strongly dependent on the tip-speed ratio, which relates the tangential speed of the turbine blade relative to the incoming wind speed. The geometry of a turbine can influence the tip-speed ratio, but the precise relationship among VAWT geometric parameters and VAWT wake characteristics remains unknown. To investigate this relationship, experiments are conducted to characterize the wakes of three VAWTs over a range of tip-speed ratios. The model turbines are geometrically similar except for the ratio of the turbine diameter (D), to blade chord (c). These experiments are conducted in a low-speed wind tunnel with flow measurements taken using two-component particle image velocimetry (PIV) and single-component hot-wire anemometer measurements at the horizontal mid-plane in the wake of each turbine. The results are compared with our numerical collaborators that performed large eddy simulations (LES) at matched flow conditions. PIV measurements are ensemble averaged in time and phase averaged with each rotation of the turbine. Hot-wire measurement are taken at points along the edge of the shear layer of each turbine wake, as deduced from the PIV data, which allows for an analysis of the frequency content of the wake due to vortex shedding by the turbine.