Stony Brook University

Department of Civil Engineering

FALL 2021 SEMINAR SERIES

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ZOOM LINK: Meeting ID: 950 8981 9867; Passcode: 860265
https://stonybrook.zoom.us/j/95089819867?pwd=NzdKQUJXU3J3NFN4VlpBUlp4bDFhUT09

Effects of Wind Turbine Blade Aeroelasticity on Pitch Control Strategies

Abstract

Wind turbine dimensions have continuously increased to benefit from higher wind speeds at higher hub-height elevations and more energy capture with larger rotors. However, upscaling wind turbines pose new engineering challenges to maintain their structural integrity. Due to the increase in the blade sizes, cyclic loads caused by turbulence, gravity, and wind shear result in significant variations as the blades sweep through the rotor area. Certainly, these fatigue loads are detrimental to the blades, having a potential effect on their lifespan. Advanced control systems such as the individual pitch control (IPC) seek to reduce fatigue loads on the rotor, reduce maintenance costs, and extend their life span. However, as blades reach lengths over 100 meters, deflection and inertial forces cannot be ignored. Traditionally, high-fidelity simulations have been considering turbine rotors to be rigid and only undergoing aerodynamic loads. To address this, we have performed Large-Eddy simulations of a wind turbine. The blades are modeled using the actuator surface model coupled with an aeroelastic model. Additionally, simulations with the IPC are compared against that of a rigid and an aeroelastic blade.

About the Speaker: Dr. Christian Santoni is a postdoctoral researcher at Stony Brook University. He obtained a bachelor's and master's degree in mechanical engineering at the University of Puerto Rico- Mayagüez and a Ph.D. at the University of Texas at Dallas (2018). His research focuses on modeling wind turbines and wind farms in high-fidelity large-eddy and mesoscale simulations, and wind turbine advanced control systems. In addition, he has contributed to the study of on-shore wind farms with realistic boundary conditions by coupling high-fidelity large-eddy simulations with the Weather Research and Forecasting (WRF) model. He is a co-developer of the large eddy simulation in-house codes UTD-WF and the Virtual Flow Simulator (VFS-Wind).