DSRC Event

Simulations of unsteady flow phenomena in a cross-flow turbine

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Cross-flow turbines rotate on an axis perpendicular to oncoming flow and have advantages such as an ability to operate in shallow waters at low tip speeds. Periodic variation of the angle of attack and the resulting flow separation and reattachment on the turbine blades, known as dynamic stall, often causes a loss of torque generation. Reynolds-averaged Navier-Stokes (RANS) simulations show that optimized sinusoidal variation of angular velocity, instead of a constant angular velocity through the turbine rotation, increases the power conversion efficiency by up to 54%. The relative flow velocity experienced by the blade is modified, hence also controlling the flow separation at the blade. The low cost RANS computations are complemented with high-fidelity large-eddy simulations (LES) to evaluate their accuracy in modeling separated flow at the moderate Reynolds number. The comparison highlights high sensitivity of the RANS model to flow confinement and differences in the flow field such as premature shedding of the leading edge vortex and a distinct vortex dissipation behavior.

About the Speaker

Mukul is a PhD student in the Mechanical Engineering program at the University of Wisconsin-Madison. He works with Professor Jennifer Franck in the Computational Flow Physics and Modeling lab. He has been working on turbulent, external flow computations for applications such as oscillating foil propulsion, flow control, and cross-flow turbines.

His home city is Ahmedabad where he completed his undergraduate program from Nirma University, followed by a master's at the Arizona State University. After this he worked at the Center for Computation and Visualization at Brown University as an HPC Application Specialist for two years, helping researchers use the shared compute cluster. He then joined the PhD program in 2018 and will be graduating during the next year.

WHEN? Monday, July 19, 2021, 4:00 pm

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WHERE? Microsoft Teams: [Meeting Link]