

distinguished speakers series

The Department of Mechanical and Materials Engineering presents:

Dr. John Cater

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Modelling Extreme Wind Events in a Wind Farm using LES

Accurate prediction of transient wind turbine wakes is important for the siting of turbines within wind farms due to wake structures that can affect downwind turbine performance and loading. This seminar will present a technique for coupling large eddy simulation of the wind with an aero-elastic turbine simulation to dynamically model both turbine operation and the genesis of wake structures. The important feature of this approach is a turbine model which actively responds to transient wind conditions in a flow simulation through the inclusion of the dynamic turbine state and controller actions. The resulting system is computationally efficient, with the ability to model multiple turbines exhibiting standard baseline control, operating in an atmospheric boundary layer flow.

The flow within a model wind farm has been analysed at several wind speeds, quantifying power losses and increased load fluctuations on downwind turbines. Increased control utilisation is also observed in wake-affected rows, along with wake meandering. The implementation of transient boundary conditions has demonstrated the ability to model extreme transient wind conditions in a turbine array simulation. The results illustrate the propagation of wind event fronts, and quantify the response of the turbines with significant pitch and yaw actuation observed.



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FRIDAY, October 21st - 11:00 a.m. McLAUGHLIN HALL ROOM 312