AEROSPACE ENGINEERING SCIENC

Seminar

Atmospheric Dynamics and Wind Turbine Response from High Performance Computing

Atmospheric energy-containing turbulent eddies pass through wind turbine rotors at the rotor scale. As they do so, they stimulate temporal and spatial variations in blade surface stress distribution as the blade boundary layers respond to large modulations in reductions in the efficiency of power extraction and in increase in fatigue failures of blades and bearings. My seminar will describe two interrelated programs of research surrounding the above issues.

I will begin with a description of the core Penn State "Cyber Wind Facility (CWF)," a blade-boundary-layer-resolved HPC computational environment designed to capture the dynamic responses of blade boundary layers to the passage of the energy-dominant daytime atmospheric eddies that drive component failures. This multi-year multi-researcher effort has led to current cyber experiments in which a rotating utility-scale wind turbine blade responds to a typical moderately convective daytime atmospheric boundary layer (ABL) "l

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