Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Dynamic Wind Loads and Vortex Structures in the Wake of a Wind Turbine HUI HU, ZIFENG YANG, PARTHA SARKAR, Iowa State University — We report an experimental study to characterize the dynamic wind loads and evolution of wake vortex flow structures downstream of a horizontal axis wind turbine (HAWT). The experiments were conducted in a wind tunnel with a wind turbine model placed in a boundary layer flow developed over rough and smooth surfaces in order to study the effects of roughness and the resulting velocity and turbulence fields on the wake characteristics and fatigue loads acting on the wind turbine. In addition to measuring dynamic wind loads (both aerodynamic forces and moments) acting on the wind turbine model using a six-component load cell, a high-resolution Particle Image Velocimetry (PIV) system was used to make phase-locked flow field measurements to quantify the time-evolution of the wake vortex and turbulence flow structures shedding from wind turbine blades. The detailed flow field measurements were correlated with the wind load measurements to elucidate the underlying physics associated with turbine power generation and fatigue loads acting on wind turbines.

Hui Hu
Iowa State University

Date submitted: 26 Jul 2010 Electronic form version 1.4