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Development of a Large Scale Field PIV System For Wake Measurement in a Wind Farm LARRY BROCK, LUCIANO CASTILLO, JIAN SHENG, Texas Tech University — Efficient utilization of wind energy requires detailed field measurements. Conventional techniques such as LIDAR and sonic anemometers can only provide low resolution point-wise measurement. Particle Image Velocimetry (PIV) is widely used in laboratory scale studies, however, has considerable difficulties for application in the field. The issues mainly arise due to the presence of background sunlight and the requirement of a large seeding volume. To address these issues, a novel, large-format, field PIV system is developed in this study. The PIV system is capable of measuring 2D velocity in a 1m X 1 m field of view with 0.2 mm spatial resolution and 7.6 mm vector spacing. The instrument achieves a three-decade measurement range, which enables the quantification of wide spectrum of wake structures as well as those in ABL. It can be applied to assess inflow conditions and to identify coherent structures in turbine wakes. The paper will present the principle of measurement and the development of optical, electrical and mechanical systems, as well as the preliminary measurement in an experimental wind farm.

Faraz Mehdi
Texas Tech University

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