Abstract Submitted
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Vortex Identification in the Wake of a Wind Turbine Array ALEKSANDR ASEYEV, RAUL CAL, Portland State University — A 4 x 3 wind turbine array boundary layer is analyzed through Particle Image Velocimetry data gathered directly forward and aft of the first and last row turbines at the centerline in a wind tunnel. Vortex identification techniques are able to capture vortical structures. Q-criterion, $Delta$-criterion, and $lambda-2$ criterion are evaluated and compared for this flow. Q-criterion and $lambda-2$ criterion provided a clear indication of regions where vortical activity exists while the $Delta$-criterion is not able to capture these regions. Galilean decomposition, Reynolds decomposition, vorticity, and swirling strength were used to further understand the location and behavior of the vortices. The various criterion displayed the high magnitude vortices, resulting from the blade tips and located immediately in areas of high shear. Using Galilean and Reynolds decomposition, swirling motions are shown hugging vortex regions in agreement with the identification criterion. The percentages used in the Galilean decomposition were 20 and 50 percent of a convective velocity of 7 m/s. As the vortices convect downstream, these vortices weaken in magnitude to approximately 25 percent of those present in the near wake.

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