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Spectral analysis of flow, wind turbine and wake interaction in low-level jet conditions ALI DOOSTTALAB, HUMBERTO BOCANEGRA EVANS, DIEGO SIGUENZA-ALVARADO, Purdue University, SHYUAN CHENG, LEONARDO CHAMORRO, University of Illinois at UrbanaChampaign, LUCIANO CASTILLO, Purdue University — The low-level jet (LLJ) is an atmospheric phenomenon characterized by relatively low-tropospheric maximum in the vertical profile of the horizontal winds which may offer an attractive power resource for wind turbines. Here, we present laboratory measurements of the velocity field and power spectral analysis of model wind turbines operating in a synthetic low-level jet. Our results reveal a large peak in the velocity spectra that arises from the interaction of the LLJ velocity peak and the tip of the rotor, which creates a strong shear layer. Although this shear layer does not have a significant effect on the spectrum of the generated power, the induced large scale velocity fluctuations may produce structural loading in wind turbines within wind farms.

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