Abstract Submitted
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Propagation of low-level jet's signals across the wind turbine structures.[1] WALTER GUTIERREZ, Department of Mechanical Engineering, Texas Tech University, Lubbock, Texas 79409, USA, ARQUIMEDES RUIZ-COLUMBIE, National Wind Institute, Texas Tech University, Lubbock, Texas 79409, USA, MURAT TUTKUN, Institute for Energy Technology (IFE), Kjeller, Norway, LUCIANO CASTILLO, School of Mechanical Engineering, Purdue University, West Lafayette, IN 47907, USA — Low-level jets (LLJs) are identified as relative maxima in the vertical profile of the horizontal wind speed at the top of the stable boundary layer. Such peaks constitute major power resources, since they are observed at altitudes within the heights of commercial-size wind turbines (e.g., ˜40m and 100 m). However, the stronger wind speed and the stronger wind shear below the peak altitude can also increase the mechanical loading on the wind turbine. Moreover, LLJs can act as a carrier of firm frequencies that can excite several of the turbine's parts. How those loads and frequencies are replicated along the turbine's structure has not been thoroughly studied. Using high-frequency data of actual atmospheric LLJ as input for the NREL aeroelastic simulator FAST, together with spectral analysis, we determine how the signal from the incoming wind is first created at the elements facing the wind and then transported across all turbine's parts. We found that the tower is the main source of perturbation breaking the symmetry of many of the turbine's responses. Results from this research can provide a better understanding of how several LLJ's features act to exacerbate or mitigate the damages on turbine's parts.

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