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The Stability of Tip Vortices Generated by a Flexible Wind Turbine STEVEN RODRIGUEZ‘, JUSTIN JAWORSKI, Lehigh University — The influence of root-vortices and a trailing vortex sheet on tip-vortex dynamics of a flexible onshore and floating-offshore wind turbine configurations are investigated numerically. The rotor near-wake is generated using a lifting-line free vortex wake method, which is coupled to a finite element solver for linear flapwise bending deformations. A synthetic time series of rigid-body rotor motions emulates the offshore environment for the NREL 5MW reference wind turbine. To evaluate the influence of root vortices and the trailing vortex sheet, a linear stability analysis is first performed for a rotor wake consisting only of the tip vortices. The stability analysis is then modified to account for the presence of the root vortices and trailing vortex sheet. Stability trends of the two analyses are compared to identify any influence that the root vortices and the trailing vortex sheet have on the tip-vortex dynamics. Lastly, the aforementioned stability analyses are conducted for varying tip speed ratios to identify intrinsically stable helical structures.

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