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Turbulent Decay of the Yawed Wind Turbine Counter-Rotating Vortex Pair¹ CARL SHAPIRO, DENNICE GAYME, CHARLES MENEVEAU, Johns Hopkins University — Yawed wind turbines generate a counter-rotating vortex pair (CVP) that deflects and deforms the turbine’s wake downstream. Informed by large eddy simulations (LES) of yawed wind turbines in the atmospheric boundary layer (ABL) and the airplane trailing vortex literature, we develop a model for the shed vorticity and circulation of the CVP. Analytical integration of a simplified form of the vorticity transport equation yields analytical equations that do not require costly numerical integration. We apply an eddy-viscosity model with the ABL friction velocity and width of the vortex sheets representing the velocity and length scales, respectively. Comparisons of the analytical model to LES measurements of the maximum vorticity and circulation magnitude show considerable agreement. These results indicate that cross-diffusion dominates the CVP decay as the vorticity cancels along the wake’s line of symmetry.

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