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Evolution of the shear layer during unsteady separation over an experimental wind turbine blade MATTHEW MELIUS, RAUL CAL, Portland State University, KAREN MULLENERS, Ècole Polytechnique Fèdèrale de Lausanne — Unsteady flow separation in rotationally augmented flow fields plays a significant role in the aerodynamic performance of industrial wind turbines. Current computational models underestimate the aerodynamic loads due to the inaccurate prediction of the emergence and severity of unsteady flow separation in the presence of rotational augmentation. Through the use of time-resolved particle image velocimetry (PIV), the unsteady separation over an experimental wind turbine blade is examined. By applying Empirical Mode Decomposition (EMD), perturbation amplitudes and frequencies within the shear-layer are identified. The time dependent EMD results during the dynamic pitching cycle give insight into the spatio-temporal scales that influence the transition from attached to separated flow. The EMD modes are represented as two-dimensional fields and are analyzed together with the spatial distribution of vortices, the location of the separation point, and velocity contours focusing on the role of vortex shedding and shear layer perturbation in unsteady separation and reattachment.

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