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POD based analysis of three-dimensional stall over a pitching wind turbine blade MATTHEW MELIUS, RAUL BAYOAN CAL, Portland State University, KAREN MULLENERS, COLE POLYTECHNIQUE FDRALE DE LAUSANNE — Aerodynamic performance of a wind turbine blade is a predominant factor in its power production. Under dynamic loading conditions, predicted aerodynamic loads often do not match operational loads. In the interest of gaining understanding of the complex flow over wind turbine blades, a three-dimensional scaled blade model has been designed and manufactured to be dynamically similar to a rotating full-scale NREL 5MW wind turbine blade. Time resolved particle image velocimetry (PIV) measurements collected over the suction surface of an inboard section of the experimental turbine blade. Flow characteristics are analyzed using coherent structure identification techniques to capture dynamic stall behavior. Proper orthogonal decomposition (POD) is applied to the velocity field providing information about separation point and stall development time scales based on the associated time coefficients and modes. Additionally, continuity and circulation calculations are used to capture three dimensional effects within stalled volumes during developing stall and re-attachment phases of dynamic stall.

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None

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