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Wind Turbine Structural Path Stress & Fatigue Reductions Resulting from Active Aerodynamics*

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ABSTRACT

Sandia National Laboratories contracted with Romax Technologies to utilize the Romax-developed detailed Gearbox Reliability Collaborative (GRC) gearbox model (validated against NREL-acquired gearbox data) to investigate the impact of Active Aerodynamic blade Load Control (AALC) on wind turbine drive train components. The turbine model used for this effort was the 750kW GRC turbine, modified for variable speed/variable pitch operation. 20% chord trailing edge flaps were added to the outer 25% of the blade span, and the NREL FAST/Aerodyne/Simulink code was utilized to generate time-series data of the turbine operating with and without AALC. These time-series data were then analyzed by Romax to investigate the impact of AALC on drive train component extreme and fatigue loads. This work found that the use of AALC significantly reduces the loads on drive train components – the bearing static stresses for limiting cases were reduced by as much as 50% and the fatigue damage for the load carrying bearings was reduced between 7 and 32%. The greatest impact of AALC on the drive train appears to be the reduction of the off-axis moments, which are often the design limiting loads for strength.