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LOAD MITIGATION WITH TWIST-COUPLED HAWT BLADES

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ABSTRACT¹

The load mitigation prospects of a blade that twists toward feather as it bends is addressed in this paper. For this investigation, the ADAMS-WT software has been modified to include blade models with bending-twist coupling. Models of a representative rotor operating at a constant speed are developed for several values of the bending-twist coupling coefficient, all in a range that assures positive definiteness of the structural stiffness. Using the twist-coupled models, the ADAMS software is exercised for a spectrum of stochastic wind time series. This spectrum contains time series with three mean wind speeds at two turbulence levels. Fatigue damage calculations are done for the generated load histories using a range of material exponents that represent materials from welded steel to aluminum to composites, and results are compared with the damage computed for the rotor without twist-coupling. Power output for the various cases is also monitored to determine power deviations resulting from the coupling. Results indicate that for high but physically attainable levels of the coupling coefficient, significant reductions in damage are achieved across the spectrum of applied wind loading.

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