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DESIGN STUDIES FOR TWIST-COUPLED WIND TURBINE BLADES

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Abstract

This study presents results obtained for four hybrid designs of the Northern Power Systems (NPS) 9.2-meter prototype version of the ERS-100 wind turbine rotor blade. The ERS-100 wind turbine rotor blade was designed and developed by TPI composites. The baseline design uses e-glass unidirectional fibers in combination with ±45-degree and random mat layers for the skin and spar cap. This project involves developing structural finite element models of the baseline design and carbon hybrid designs with and without twist-bend coupling. All designs were evaluated for a unit load condition and two extreme wind conditions. The unit load condition was used to evaluate the static deflection, twist and twist-coupling parameter. Maximum deflections and strains were determined for the extreme wind conditions. Linear and nonlinear buckling loads were determined for a tip load condition. The results indicate that carbon fibers can be used to produce twist-coupled designs with comparable deflections, strains and buckling loads to the e-glass baseline.