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Modal Testing of the TX-100 Wind Turbine Blade

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Abstract

This test report covers the SNL modal test results for two nominally identical TX-100 wind turbine blades. The TX-100 blade design is unique in that it features a passive braking, force-shedding mechanism where bending and torsion are coupled to produce desirable aerodynamic characteristics. A specific aim of this test is to characterize the coupling between bending and torsional dynamics. The results of the modal tests and the subsequent analysis characterize the natural frequencies, damping, and mode shapes of the individual blades. The results of this report are expected to be used for model validation -- the frequencies and mode shapes from the experimental analysis can be compared with those of a finite-element analysis. Damping values are included in the results of these tests to potentially improve the fidelity of numerical simulations, although numerical finite element models typically have no means of predicting a structure's damping characteristics. Thereafter, an additional objective of the test is achieved in evaluating the uncertainty in the modal parameters and the unit to unit variation of the two blades.