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Experimental evidence for coupled-mode flutter in a two-meter long parked wind turbine blade[1] PIETER BOERSMA, BRIDGET BENNER, TODD CURRIER, YAHYA MODARRES-SADEGHI, University of Massachusetts Amherst — We have conducted a series of experiments on a relatively large-scale wind turbine blade and observed coupled-mode flutter. Theoretical studies predict that the future wind turbine blades are susceptible to coupled-mode flutter. Experimental validation of this prediction is difficult, due to the inherent complications in conducting experimental work on structures that could become unstable due to flutter. We have built a relatively large (although small-scale compared to the 61-meter long full-scale blade) scale model of the NREL 5 MW blade from a flexible plastic. The blade was 2 meters long and was comprised of two 0.5 cm-thick shells bonded together such that the torsional natural frequency and the flapwise natural frequencies had a similar ratio to those in the full-scale. This was important, because the theoretical predictions suggest that the third flapwise and the first torsional natural frequencies coalesce into a coupled mode flutter mode. Our experimental results clearly show this coalescence and the resulting mode of oscillations in which a combined flapwise and torsional motion is observed.

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