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Effects of Materials Parameters and Design Details on the Fatigue of Composite Materials for Wind Turbine Blades

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ABSTRACT

This paper presents an analysis of the results of nine years of fatigue testing represented in the U.S. Department of Energy / Montana State University (DOE/MSU) Composite Materials Fatigue Database. The focus of the program has been to explore a broad range of glass-fiber-based materials parameters encompassing over 4500 data points for 130 materials systems. Significant trends and transitions in fatigue resistance are shown as the fiber content and fabric architecture are varied. The effects of structural details including ply drops, bonded stiffeners, and other geometries that produce local variations in fiber packing and geometry are also described. Fatigue tests on composite beam structures are then discussed; these show generally good correlation with coupon fatigue data in the database. Goodman diagrams for fatigue design are presented, and their application to predicting the service lifetime of blades is described.