

SAND94-2459
Unlimited Release
Printed February 2000

Theory Manual for FAROW Version 1.1: A Numerical Analysis of the Fatigue and Reliability of Wind Turbine Components

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Abstract

Because the fatigue lifetime of wind turbine components depends on several factors that are highly variable, a numerical analysis tool called FAROW has been created to cast the problem of component fatigue life in a probabilistic framework. The probabilistic analysis is accomplished using methods of structural reliability (FORM/SORM). While the workings of the FAROW software package are defined in the user's manual, this theory manual outlines the mathematical basis. A deterministic solution for the time to failure is made possible by assuming analytical forms for the basic inputs of wind speed, stress response, and material resistance. Each parameter of the assumed forms for the inputs can be defined to be a random variable. The analytical framework is described and the solution for time to failure is derived.