FREQUENCY DOMAIN ANALYSIS OF THE FATIGUE LOADS

ON TYPICAL WIND TURBINE BLADES

Herbert J. Sutherland

Wind Energy Technology

Sandia National Laboratories

Albuquerque, NM 87107

ABSTRACT

The fatigue analysis of a wind turbine blade typically depends on converting time-series data to a series of load cycles using one of several cyclic counting algorithms. However, many structural analysis techniques yield frequency-domain stress spectra, and a large body of experimental loads (stress) data is reported in the frequency domain. To permit the fatigue analysis of this class of data, a series of computational algorithms based on Fourier analysis techniques has been developed. The principle underlying these algorithms is the use of an Inverse Fast Fourier Transform (FFT) to transform the frequency spectrum to an equivalent time series suitable for cycle counting. In addition to analyzing the fatigue loads along the primary blade axes, this analysis technique also permits the examination of "off-axis" bending loads. These algorithms, which have been incorporated in the LIFE2 fatigue analysis code for wind turbines, are illustrated and evaluated with data from typical wind turbine blades.