

A Study on Periodicity of Wind Speed

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Abstract

The volatility of wind is one of the essential adverse factors to operating and planning of a power system with large share of renewables. In fact, random variability of wind speed has some hidden periodic patterns in various time scale. Understanding any pattern of wind speed can provide significant basis for wind resource assessment, wind power forecasting, wind farm operation and maintenance, et al. However, the wind pattern is difficult to extract only in a time domain. Therefore, this motivates the study of wind pattern in a frequency domain. In this paper, a new method to distinguish the periodicities of wind speed in various time scales is proposed based on improved Morlet wavelet. A time-frequency correction factor is added in the original mother wavelet to improve its adaptability for analyzing periodicity of a variable with high variability, such as wind speed. The obtained wavelet variance is the quantification of the periodicity intensity. To investigate how some meteorological parameters affect the wind periodicity, the correlations of periodicities of wind speed and temperature, humidity are analyzed in different regions and different seasons. Data from met masts at Colorado and North Carolina from NREL are used as example. The results show that the proposed method is capable of obtaining the periodicity components in different time scales and quantifying their intensities. And, the periodicities of wind speed and temperature have strong correlation in annually, seasonally and monthly time scales, and their correlation value are different with regions and seasons.