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Wind speed generation for dynamic analysis

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Abstract— A simple model to generate large band wind speed time sequences, especially easy to implement with a very reduced number of parameters, is presented. It is based on the calculation of a low-frequency and a high-frequency components. Low-frequency component with 1 h sample time is obtained from a random process based on a conditional probability density function. Using real data from two different wind farms in two different months of the year, it has been found that Weibull distribution centered in the current hourly mean value seems to represent well the 1 h conditional PDF in all cases, and the standard deviation of this conditional Weibull is more or less in the range 1-1.3 m s-1 independently of the season of the year or the location. Regarding to high-frequency component, low-frequency samples are used as initial and final values and, between them, the turbulence component values are inserted. For that, it has been used a stochastic process based on a Beta probability function and a simple rescaling procedure with two non-linear parameters, calculated in a recursive way. Unlike the usual modelling procedures presented in the literature, spectral power density functions are not used. This simplifies the implementation significantly. Ten second sample-time real speed wind data from two different wind farms have been used to validate the proposed high-frequency model, obtaining excellent results. A thorough revision of the main models found in the literature to produce wind speed time sequences for dynamic analysis is performed in the paper.

Index Terms— wind speed generation; wind speed modelling

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