可再生能源发电

风力发电机组风场模拟

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摘要： 为考虑风力发电机组桨叶旋转效应，准确确定作用在桨叶风荷载，研究基于旋转样本谱进行风场模拟的问题。基于旋转样本谱的物理机制，从脉动风速Fourier展开的角度出发，首先推导脉动风速Fourier展开系数互谱，结合d 函数的性质，提出基于物理机制的旋转样本互谱模型，并与旋转样本自谱共同构建了旋转样本谱矩阵。以旋转样本谱矩阵为基础，通过对其进行Cholesky分解，依据谱表现法实现风力发电机组脉动风场模拟。最后，结合典型的1.25 MW三桨叶变桨距风力发电机组进行纵向风速场数值仿真。研究表明，该算法可以准确地模拟给定风环境的风力发电机组脉动风速时程。

关键词： 风力发电机组　旋转样本谱　物理机制　风场模拟　脉动风速

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Abstract: In order to consider the rotational effect of blades and determine the exact loads of the wind turbine system, wind field simulation based on the rotationally sampled spectrum was studied. Firstly, based on the physical mechanism of the rotationally sampled spectrum, the cross spectrum of Fourier expansion coefficients of the fluctuating wind speed was deduced, and the rotationally sampled spectrum model, which takes the rotational effect into account, was proposed with function d being considered. Then according to the spectrum representation method, the random turbulent wind speed field was generated by superposing a set of cosine functions, after the rotationally sampled spectrum matrix was decomposed with Cholesky's method. Finally, an example involving simulation of the longitudinal turbulent wind field of a 1.25 MW three-bladed pitch regulated wind turbine system was investigated. The result shows that the proposed algorithm is of high accuracy.

Keywords: wind turbine system　rotationally sampled spectrum　physical mechanism　wind field simulation　turbulent wind velocity

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