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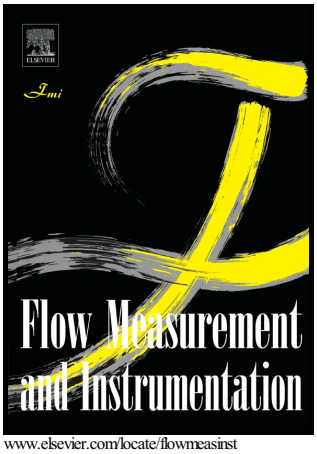

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Estimation of fractal representation of wind speed fluctuation by artificial neural network with different training algorothms

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Abstract

Since the wind speed fluctuation could cause large instability in wind energy systems it is crucial to develop a method for precise estimation of the wind speed fluctuation. Fractal interpolation of the wind speed could be used to improve the accuracy of the estimation of the wind speed fluctuation. Based on the self-similarity feature, the fractal interpolation could be established from internal to external interval. In this article fractal interpolation was used to improve the wind speed fluctuation estimation by soft computing methods. Artificial neural network (ANN) with different training algorithms were used in order to estimate the wind speed fluctuation based on the fractal interpolation.

Keywords: wind speed; fractal interpolation; soft computing; prediction.

1. Introduction

Since the conventional energy sources are limited and the main reason of the world environmental pollution, there is need to increase the usage of renewable energy sources. One of the cleanest renewable energy is wind energy which becomes very popular energy sources recently. However, wind speed fluctuation is the main problem for the wind power generation since it is very randomness and uncontrollable [1].

Complex terrain could cause large fluctuation in wind speed. In other words the terrain topography could produce strongly variable wind speed [2]. There are some data-driven standardization schemes for wind speed estimation for different terrains [3]. There is large influence of the terrain on the wind speed fluctuation [4, 5]. Artificial neural networks (ANN) were applied to determine annual wind speed for some complex terrain [6]. Computational fluid dynamics (CFD) was also used for investigate the effect of the terrain features on the wind speed fluctuation [7, 8]. There is stochastic nature of the wind direction data over complex terrains [9,

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