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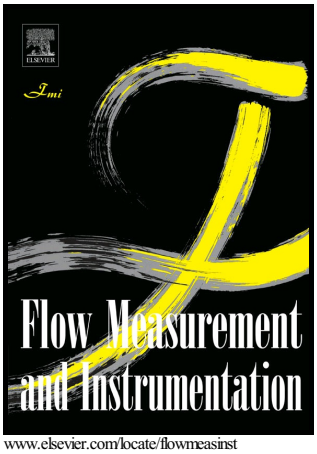

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Management of the wind speed data using adaptive neuro-fuzzy methodology

Srdjan Jovic[1], Obrad Anicic[1*], Branko Pejovic[1]

[1]University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Kneza Milosa 7, 38 220 Kosovska Mitrovica, Serbia

[*]Corresponding author: anicicobrad@gmail.com

Abstract

In this paper, the accuracy of the Weibull model of wind speed is evaluated using an adaptive neuro-fuzzy inference system (ANFIS) based on wind data. The wind data comprises of wind speed measurements in the city of Nis in Serbia at different heights of 10 m, 30 m and 40 m for duration of one year. The ANFIS results are compared with the experimental results and Weibull model using root-mean-square error (RMSE), coefficient of determination, and Pearson coefficient. The effectiveness of the proposed unified strategy is verified based on the simulation results.

Keywords: ANFIS; Wind speed; Weibull distribution.

1. Introduction

Wind plays a central role in many applications, such as exploring wind energy and bridge construction. Hence, having knowledge of wind characteristics is of great importance. When the probability density of wind speed is known, characteristics such as mean, variance and power density can be easily determined. In recent years, the Weibull distribution has been a commonly applied, accepted and recommended distribution for the evaluation of wind energy potential addressed in literature.

Wind speed has very fluctuated behavior and therefore it would be really important to determine the probability density distribution of the wind speed. This is simply the distribution of the proportion of time spent by the wind within narrow bands of wind speed. Standard deviation is the main measure of the unsteadiness of the wind speed. A generalized expression is required for the probability density distribution. There are several probability distribution functions to model wind speed data. Weibull distribution is generally regarded as a widely used expression that provides a favorable fit to wind data [1, 2]. According to Gumbel [1], Weibull function is the best probability distribution function among one or two parameter distribution function families which has accuracy, flexibility and adaptability. The Weibull function enjoys the advantage of quickly determining the average annual yield of a wind turbine. The first step prior to determining the Weibull probability density function is calculation of two parameters of