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Potential of neuro-fuzzy methodology to estimate noise level of wind turbines

Vlastimir Nikolić [a], Dalibor Petković [a,*], Por Lip Yee [b], Shahaboddin Shamshirband [b], Mazdak Zamani [c], Žarko Ćojbašić [a], Shervin Motamedi [d]

[a] University of Niš, Faculty of Mechanical Engineering, Department for Mechatronics and Control, Aleksandra Medvedeva 14, 18000 Niš, Serbia
[b] Department of Computer System and Technology, Faculty of Computer Science and Information Technology, University of Malaya, 50603 Kuala Lumpur, Malaysia
[c] Advanced Informatics School (AIS), Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia
[d] Institute of Ocean and Earth Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia

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ABSTRACT

Wind turbines noise effect became large problem because of increasing of wind farms numbers since renewable energy becomes the most influential energy sources. However, wind turbine noise generation and propagation is not understandable in all aspects. Mechanical noise of wind turbines can be ignored since aerodynamic noise of wind turbine blades is the main source of the noise generation. Numerical simulations of the noise effects of the wind turbine can be very challenging task. Therefore in this article soft computing method is used to evaluate noise level of wind turbines. The main goal of the study is to estimate wind turbine noise in regard of wind speed at different heights and for different sound frequency. Adaptive neuro-fuzzy inference system (ANFIS) is used to estimate the wind turbine noise levels.

1. Introduction

Wind turbine (WT) noise effect can be considered as one of the main technical issue to the implementation of WT. There are two noise sources of WT, mechanical and aerodynamic noise. Mechanical noise can be dropped by structuring of the mechanical components. On the other hand, the aerodynamic noise is very challenging task to overcome. There are two types of the aerodynamic noises: discrete (tonal) and broadband noise. Tonal noise low frequency noise and it is generated by the movement of WT blades which caused disturbance in flow. On the other hand, the broadband noise, which is higher frequency noise, is generated by turbulent flows. It is needed to predict and estimate aerodynamic noise of WT in order to reduce the noise.

Many researchers investigated the WT noises so far. The change of WT noise due to blade flexibility was investigated in [1]. It was shown that the more flexibly blades produces less noise. In article [2] the turbulence effect of the noise generation was analysed. One numerical method for prediction of the WT noise was developed in [3] which were based on Reynolds-averaged Navier–Stokes (RANS) based solver. Another numerical method based on Ray theory was used to characterize the WT noise

* Corresponding author. Tel.: +381 643283048.
E-mail address: dalibortc@gmail.com (D. Petković).

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