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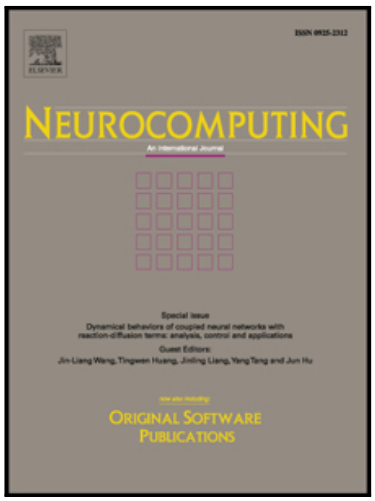

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Estimation of wind speed probability distribution and wind energy potential using adaptive neuro-fuzzy methodology

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Abstract

The probabilistic wind speed distribution and evaluation of wind energy potential are very important factors while selecting a suitable site for wind turbine installation and estimating wind farm design parameters. Wind farm designers use Weibull wind speed probability distribution function (PDF) to analyze the wind speed characteristics and variations at a specific site. In this study, a hybrid intelligent learning based adaptive neuro-fuzzy inference system (ANFIS) is proposed to accurately estimate the Weibull wind speed PDF and the results are compared with five well-known numerical methods. The results indicate that ANFIS provides the best fit of measured Weibull distribution curve. The Weibull parameters are further utilized to calculate some important parameters which are helpful to estimate the wind energy potential of a site. Then the problem of selecting the most efficient and economically viable wind turbine is addressed. For this purpose, four small scale wind turbines are taken into consideration for available wind resources. The average electrical power, the annual energy produced and the capacity factor are calculated to check the economic viability each wind turbine model.

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