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A new optimal feature selection algorithm for classification of power quality disturbances using discrete wavelet transform and probabilistic neural network

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Abstract: **Automatic classification of Power Quality Disturbances (PQDs) is a challenging concern for both the utility and industry. In this paper, a novel technique of automatic classification of single and hybrid PQDs is proposed. The proposed algorithm consists of the Discrete Wavelet Transform (DWT) and Probabilistic Neural Network based Artificial Bee Colony (PNN-ABC) optimal feature selection of PQDs. DWT with Multi-Resolution Analysis (MRA) is used for the feature extraction of the disturbances. The PNN classifier is used as an effective classifier for the classification of the PQDs. However, the two critical concerns such as the selection of the optimal features and the spread constant value might affect the performance of the classifier. Hence, these two issues are addressed using a novel technique PNN-ABC based optimal feature selection and parameter optimization for improving the performance of the classification system. The ABC algorithm is used to select optimal features from a large feature set and the optimal value of the PNN spread constant. The optimal feature selection method retains the useful features and discards the redundant features. The performance of the proposed algorithm is evaluated by PSCAD/EMTDC simulation of a typical 11 kV underground distribution system of Malaysia. The noise-riding PQDs have also been analyzed to validate the sensitivity of the proposed algorithm. The simulation results show that the new PNN-ABC based optimal feature selection algorithm is proficient and accurate in classifying the PQDs.**

Keywords: *Power quality disturbances, feature extraction, optimal feature selection, discrete wavelet transform, artificial bee colony, probabilistic neural network.*

1. Introduction

The term Power Quality (PQ) is attributed to the quality of voltage and current waveforms, concerned to detect the variation in ideal supply voltage and load current waveforms [1]. The power quality disturbances are defined as the sudden variation or distortion in voltage and/or current amplitude, phase angle and frequency. These disturbances are produced due to the application of unbalanced and non-linear loads, switching devices, line faults, industrial grade converters, computers and data processing equipment, usually applied in both the industrial and domestic appliances [2]. The growing interest in PQ can further be resulted due to the complicated power distribution networks with the