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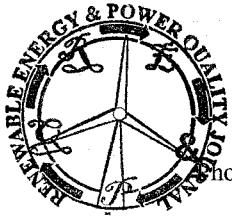
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## Wavelet based feature extraction for classification of Power Quality Disturbances

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**Abstract.** The detection and classification of power quality disturbances in power systems are important tasks in monitoring and protection of power system network. Most of the power system disturbances are non stationary and transitory in nature and new tools are being used nowadays for the analysis of power quality disturbances. This paper presents a wavelet based feature extraction method for the detection and classification of power quality disturbances. The disturbance waveforms obtained from simulation are decomposed by wavelet packet transform. The energy distribution pattern of the distorted signals has been chosen for feature extraction. Various power quality disturbances have been tested such as voltage sag, interruption, voltage swell, transient, flicker, low frequency and high frequency disturbances

### Key words

power quality, wavelet packet transform, energy distribution, power quality disturbance.

### 1. Introduction

Power quality study has become an important subject in recent years because poor power quality may cause many problems for the affected loads such as malfunctions, instabilities, short life time and many others. Hence detection and classification of power quality disturbances is a challenging task for the power system engineers. The disturbance waveforms contain serious imprecision data and directly provide very little information for identification of power quality problems. Hence power quality experts are needed for the development of expert systems which can detect and classify power quality problems.

Wavelet transform in combination with Fourier can extract unique features from voltage and current waveforms that characterize power quality events [1]. The Fourier transform is used to characterize steady state phenomena and the wavelet transform is applied to transient phenomena. The concept of discrete wavelet transform for feature extraction of power disturbance

signal combined with fuzzy logic and artificial neural network is a powerful tool for detecting and classifying power quality problems. A wavelet based extended fuzzy reasoning approach for power quality disturbance recognition and identification has been proposed in [2]. To extract power quality disturbance features the energy distribution at different levels of decomposition has been considered and based on these features rule bases are generated for extended fuzzy reasoning. In [3] wavelet based neural network classifier for recognizing power quality disturbances is implemented and tested under different conditions. Here the discrete wavelet transform is integrated with probabilistic neural network model to construct the classifier. The paper [4] employs a different type of univariate randomly optimized neural network combined with discrete wavelet transform and fuzzy logic to have better power quality disturbance classification accuracy. Here the system is modeled using VHDL hardware description language (VHDL) followed by extensive testing and simulation.

A wavelet feature extraction technique based on norm entropy is proposed in [5] for automatic power quality disturbance classification. The disturbance classification is performed with wavelet neural network. Another wavelet entropy based approach for power system transient classification is presented in [6]. Here neural network is employed for automatic power system transient classification. Based on wavelet transform the idea of entropy and weight coefficient is introduced and the wavelet energy entropy and wavelet entropy weight are defined in [7]. Here also with the help of neural network classifier transient signals have been classified. A novel approach for the recognition of power quality disturbances using multiwavelet transform and neural network is discussed in [8]. Another hybrid methodology using wavelet transform and neural network to automatically detect, locate and classify disturbances affecting power quality is presented in [9]. A new voltage sag detection method based on wavelet transform is developed in [10]. The developed voltage sag detection algorithm is