ABSTRACT

The quality of electric power is the most important requirement in power system operation and control. The main causes for degradation of power quality, in any electrical power distribution system are by nonlinear loads which make the issues more complex and diversified. Any power system which handles nonlinear loads will face all types of power quality issues such as, voltage sag, swell, harmonics and notch which ultimately leads to complete collapse of a power system. This makes the power system engineers to design and develop new techniques, to identify and classify power quality problems to enhance power system performance. To develop they need to analyze the power quality data of the particular case, which normally will be huge in number, so there come's appropriate selection of data for the analysis. Conventionally there are many techniques to handle these kinds of data but computational cost and time will be more. These issues force the power system engineers to formulate and develop intelligent techniques to handling power quality data to have better identification and classification.

Hence wavelet based radial basis function neural network (RBFNN) is proposed in this work to detect and classify power quality disturbance in the power system. The proposed method requires less number of features as compared to conventional approach and other considered work for the identification. The feature extracted through the Wavelet Transforms (WT) is trained by RBFNN network for the classification of events. After training the neural network, the weight obtained is used to classify the power quality (PQ) problems. For the classification, 20 types of disturbance are taken in to account. The classification performance of wavelet based RBFNN is compared with Feed Forward Multilayer Network (FFML), Learning Vector Quantization (LVQ), Generalized Regressive Neural Network (GRNN) and Probabilistic Neural

Network (PNN). The simulation results possess significant improvement over existing methods in signal detection and classification. Next to improve the accuracy level further, the Wavelet Transform Based Fuzzy Logic (WT-FL) is proposed in detection and classification. The features such as Slop, Energy, Standard Deviation, Variance, Skewness, Kurtosis, Shannon Entropy, Log Energy, Entropy and Norm Energy are used as inputs and fuzzy rules are framed based on the power quality standards.

It is evident from the results, the classification accuracy of wavelet based fuzzy logic has been improved further as compared to wavelet based RBFNN. Again, for further improvement of detection and classification accuracy, Particle Swarm Optimization (PSO) is proposed along with wavelet based fuzzy logic. The PSO is used to determine the ranges of the features in membership function to identify each disturbance specifically. The simulation results of wavelet based FL-PSO possesses significant improvement and gives classification results in less than a cycle when compared to other considered approaches.