

**UNIVERSITI TEKNOLOGI MARA
CAWANGAN PULAU PINANG**

**PERFORMANCE OF LEVENBERG-MARQUARDT
NEURAL NETWORK ALGORITHM IN POWER
QUALITY DISTURBANCES CLASSIFICATION**

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The increasing complexity of modern power systems necessitates advanced methods for detecting and classifying power quality disturbances (PQDs), which impact system reliability and equipment performance. This study investigates the application of the Levenberg-Marquardt (LM) neural network algorithm for classifying PQDs such as voltage sags, swells, and transients. A simulation-based methodology was adopted, leveraging MATLAB®/Simulink to model a power grid and generate synthetic PQD waveforms. The classification process incorporated Root Mean Square (RMS) analysis for feature extraction and multilayer perceptron (MLP) neural networks for pattern recognition. Results demonstrated that the LM algorithm outperformed Bayesian Regularization (BR) and Scaled Conjugate Gradient (SCG) methods in terms of accuracy, convergence speed, and computational efficiency, achieving near-perfect regression values and minimal mean square error for most PQD types. Confusion matrix analysis confirmed the robustness of the LM-based classifier across varying input data ratios. This study highlights the potential of LM neural networks in improving PQD monitoring and supports the advancement of effective and dependable power quality management systems. Future work should explore real-world implementation and integration with diverse grid configurations to validate scalability and adaptability.

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