Detection and Classification of Power Quality Disturbances on Transmission Line Using Wavelet Transform a Artificial Neural Network and CNN

Chinmay Patil and Akshit Samadhiya

Master of Technology in Electrical Engineering with Specialization in "Electrical Power Systems"
Department of Electrical and Electronics Engineering
School of Engineering and Technology, Sandip University, Nashik

Abstract: *In modern power systems, the quality and reliability of electrical power have become critical due to the increasing use of sensitive electronic equipment. Power quality disturbances (PQDs), such as voltage sags, swells, transients, interruptions, and harmonics, can severely impact the performance and lifespan of electrical appliances.[1][2] Transmission lines, being a major component of power delivery infrastructure, are prone to these disturbances due to environmental factors, switching operations, and system faults. Accurate detection and classification of PQDs are essential for fast protective actions and preventive maintenance. Traditional methods like Fourier analysis are limited by poor time resolution and inability to detect transient events.[3] Wavelet Transform (WT) offers a time-frequency representation that is well-suited for detecting non-stationary disturbances. Recent advances in artificial intelligence, especially in machine learning and deep learning, have enabled intelligent systems that can learn disturbance patterns and classify them with high accuracy.[5][6]*

This paper proposes a method combining Discrete Wavelet Transform for signal pre-processing and feature extraction with two classification models—Artificial Neural Network and Convolutional Neural Network—to detect and classify multiple PQDs. The proposed method enhances the accuracy and speed of classification, making it suitable for practical deployment in smart grid monitoring and control systems.[3][20].

Keywords: **Wavelet Transform, Power Quality Disturbances, Transmission Line Faults, Artificial Neural Network, Convolutional Neural Network, Fault Detection, Fault Classification, PSCAD**