UNIVERSITI TEKNOLOGI MARA

IDENTIFICATION OF TRANSIENT OVERVOLTAGE USING DISCRETE WAVELET TRANSFORM WITH MINIMIZED BORDER DISTORTION EFFECT AND SUPPORT VECTOR MACHINE

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ABSTRACT

The rapid growth of electric power industry today has changed the conventional framework as far as power quality issues are concerned. Power quality issues such as power quality disturbances can substantially affect high sensitive utilization equipment like the malfunction of sensitive electronic medical equipment and adjustable speed motor drives trip off-line. Common power quality (PQ) disturbances can be listed into classes such as overvoltage, under voltage, transients, flickers, and harmonic distortion. Among the prominent disturbances which tremendously interrupt in the Malaysian electrical power system is transient overvoltage. The concern of PQ disturbances detection and classification are increased to ensure the sustainability of equipment operation. PQ disturbances are non-stationary signals and could be analysed by using signal processing which lead us to detect the localization and time of transient occurrence. However, the existing of border distortion effects at the edges of signal can produce inaccurate detection of transient signals when deploying the signal processing method. Therefore, there is a need to develop the technique of minimizing this border distortion effect whilst using the signal processing method. In this study, the extension mode has been proposed to minimize the border distortion effect. In order to observe the effectiveness of the proposed method, the Discrete Wavelet Transform (DWT) based one-cycle window technique is used to extract the features of transient disturbances signal. The disturbances contain imprecision of data and provide insufficient information causing the conventional method to fail in identifying any power quality problems. Thus, a detection and classification method known as Artificial Intelligence (AI) was introduced to acquire a reliable and accurate classification technique. The performance of the proposed algorithm has been analysed using Support Vector Machine (SVM) toolbox in Matlab 2017a. From the results obtained, DWT was capable to extract the features from disturbances signal through the decomposition of approximation and details coefficient performance. The novel approached of one-cycle sliding window with the association of extension mode were validated through the SVM classification. The performance of absolute reconstructed signal after the threshold technique shows that smooth padding of first derivatives is the most effective extension mode to reduce the border distortion effect using a one-cycle sliding window. Overall, the SVM classification performance based one-versus-one (OVO) coding design for original signal, smooth padding of first derivatives (spd) signal and symmetrisation (sym) signal, demonstrated that the transient and non-transient was capable to be detected after going through all the subsequent processes.

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