UNIVERSITI TEKNOLOGI MARA

FAULT CLASSIFICATION IN POWER TRANSMISSION AND DISTRIBUTION SYSTEMS USING CLASS DEPENDENT FEATURE AND 2-TIER MULTILAYER PERCEPTRON NETWORK

MAT NIZAM BIN MAHMUD

MSc

12th Dis 2016

ABSTRACT

Fault frequently occur in transmission lines and become a major issue in power system engineering. It is an unavoidable incident and leads to many problems such as failure of equipment, instability in power flow, and economical losses. Therefore, suitable protection scheme is essential to reduce the misclassification of protection relay. Recent studies on power system engineering utilised fault transient signals using Wavelet Transform (WT) and Artificial Neural Network (ANN) for fault classification in transmission lines. Fault transient signals have been reported to be robust against surroundings inconsistency. However, the presence of ground fault (g) in three phase faults has caused difficulty in separation of fault types. This is due to the input signals that only contain three phase currents and voltages. Recent studies also show that ANNs are powerful tools for fault classification. However, most studies utilised single ANN structure to classify all the faults, even though not all fault classes are equally difficult to distinguish from the true class label. This approach will result in large size of ANN involved, outputs are difficult to optimise, and their performance is usually lower than that of smaller networks. This thesis proposes a method for fault classification using WT and 2-Tier ANN. In the first stage, six common wavelet features known as energy (E), mean (μ), standard deviation (σ), entropy (H), kurtosis (K), and skewness (γ) are analysed and the best performing features are selected. Then, the selected features are input into the first Multilayer Perceptron (MLP) network to classify phase faults (A, B and C). Next, a new feature that properly describe the presence of ground fault called Class-Dependence Feature (CDF) is proposed. The CDF is determined from the correlation between the output of first ANN and wavelet mean and energy features. Then, the CDF is fed into the second ANN and used to determine the presence of ground fault. Comparison performance with different ANN structures and different types of classifier indicated that the proposed method showed good classification accuracy. The average accuracy of CDF and 2-Tier MLP network for three different datasets, ideal (no noise), 20 dB and 30 dB shows the highest with 99.36% as compared to other structures and classifiers. The presented method have also been implemented in IEEE 9 Bus transmission line system and radial distribution network and produces acceptable classification accuracy of 97.42 % and 97.99% respectively.