High-impedance fault detection in medium-voltage distribution network using computational intelligence-based classifiers

ABSTRACT

This paper presents the high-impedance fault (HIF) detection and identification in medium-voltage distribution network of 13.8 kV using discrete wavelet transform (DWT) and intelligence classifiers such as adaptive neuro-fuzzy inference system (ANFIS) and support vector machine (SVM). The three-phase feeder network is modelled in MATLAB/Simulink to obtain the fault current signal of the feeder. The acquired fault current signal for various types of faults such as three-phase fault, line to line, line to ground, double line to ground and HIF is sampled using 1st, 2nd, 3rd, 4th and 5th level of detailed coefficients and approximated by DWT analysis to extract the feature, namely standard deviation (SD) values, considering the time-varying fault impedance. The SD values drawn by DWT technique have been used to train the computational intelligence-based classifiers such as fuzzy, Bayes, multi-layer perceptron neural network, ANFIS and SVM. The performance indices such as mean absolute error, root mean square error, kappa statistic, success rate and discrimination rate are compared for various classifiers presented. The results showed that the proffered ANFIS and SVM classifiers are more effective and their performance is substantially superior than other classifiers.

Keyword: High-impedance fault; Discrete wavelet transform; Adaptive neuro-fuzzy inference system; Support vector machine; Multi-layer perceptron neural network (MLP); Bayes and fuzzy classifier