ARTIFICIAL INTELLIGENCE BASED POWER SYSTEM FAULT CLASSIFICATION AND LOCATION

by

PAPIA ROY
Department Of Electrical Engineering

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CERTIFICATE

This is to certify that the thesis entitled "**ARTIFICIAL INTELLIGENCE BASED POWER SYSTEM FAULT CLASSIFICATION AND LOCATION**" which is being submitted by **Ms. Papia Roy** to the Indian Institute of Technology Delhi, for the award of **Doctor of Philosophy**, is a bonafide research work carried out by her. She has worked under my supervision and guidance and has fulfilled the requirement for the submission of this thesis. The thesis, in my opinion, has attained a standard required for a Ph.D. degree of this Institute. The results contained in this thesis have not been submitted elsewhere in part or full for the award of any degree or diploma.

(Dr. B. K. Panigrahi)
Associate Professor
Department of Electrical Engineering
Indian Institute of Technology, Delhi
New Delhi-110016

(Dr. N. Senroy)
Associate Professor
Department of Electrical Engineering
Indian Institute of Technology, Delhi
New Delhi-110016

Date:

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Date: **Papia Roy**

Place:

ABSTRACT

Basic goal of a power system is to provide continuous electrical energy to the users. Like any other system, faults may occur in power systems too. In such situations, it is necessary that a proper restoration process be applied as soon as possible after the fault location and type are accurately detected. When fault occurs, restoration of power supply is made possible after the maintenance crew finishes the repairs of the damages caused by the fault. This thesis focuses mainly on fault classification and location for different configuration of transmission and distribution lines.

Various fault classification and location approaches based on artificial intelligence method in combination with signal processing techniques have been investigated. In this thesis, a fast and accurate hybrid artificial intelligence based fault classification and location method in a transmission and distribution line has been proposed, which reduces the estimation error substantially and relies on a single cycle of post fault current and voltage signal. The impact of the presence of thyristors controlled series capacitor, static synchronous series compensator and distributed generators have also been taken into consideration. The proposed fault classification and location method uses properly sampled values of the faulty current and voltage signal from the relaying end of the transmission/ distribution line. Thereafter, signal decomposition has been carried out using wavelet transform, wavelet packet transform and S-transform to extract a set of statistical features that may be used to carry out fault location estimation and fault classification. To reduce the computational burden of processing large data sets, feature extraction has been used where only the relevant features are extracted from the superset of features. The selected features are then fed to neural network or support vector machine for fault classification and location. The performance of the proposed fault classification and location method has been

tested on transmission and distribution lines with different configurations. A wide variety of operating conditions like fault resistance, fault inception angle, fault type and fault location have been considered to generate train and test data set. It is concluded that the fault classification and location method based on S-transform in combination with extreme learning machine and forward feature selection technique, classifies and locates the fault with highest accuracy as compared to other fault classification and location approaches.

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