Fault Locations in Subtransmission Systems by Evolutionary Algorithms

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ABSTRACT

The growing market needs for better Power quality standards have made utilities to improve their network operation procedures by the use of adequate software and hardware to cope with such issues.

This paper deals with fault location based on a power quality monitoring system. When such faults lead to interruption of service by the protection system, a fault location algorithm can ensure a rapid location so that emergency crews can proceed to the repair as soon as possible to restore the system.

Faults in transmission lines can occur due to many factors such as isolation problems, fires close to transmission lines, external agents leading to contacts between phases or phases to ground. Most faults are phase-to-ground.

In order to locate where the fault actually occurred, one should know most characteristic parameters of the transmission lines, power transformers, and additional equipment in the power system as well as fault type and impedance. Such fault characteristics are generally not know, what makes difficult location the fault.

On the other hand, power quality meters are becoming more available. Although few power quality meters are generally available, they can contribute to better locate system faults.

The literature survey shows some few works that use techniques such as neural networks and the Bayes theorem. The present paper makes use of an evolutionary algorithm for online fault location in subtransmission systems. Evolutionary algorithms have been widely used to deal with Electrical Engineering Problems. In fault location, the search features of this algorithms are suitable to estimate the specific location in a specific line, the fault impedance and the fault type, given a number of power quality meters that record current and voltage information during fault conditions.

The basis of the developed model, including individual codification, evolution operators and fitness function, is presented in the paper. The model was tested in a real fault location system, by comparing this approach an exhaustive search method that minimizes the minimum squared error between calculated and measured values.

We used a codification of individuals with continuous variables (distance to the point of simulated fault, impedance of fault) and discrete (name of the feeder, type of fault). Where to generate thousands of combinations and difficult problem of bringing a solution.

To determine the values of the parameters in the process of optimization (selection, crossing and mutation), techniques were developed to diversify (is not in great locations) and intensify the search for those individuals with values of objective function of good quality.

In practice it was observed that some meters are misreading the energy that brings an inconsistency of data, therefore, initially was done an estimate of states, to

determine those with readings meters with gross errors. Those meters with gross errors are disregarded in the process of optimization.

A specific interface was also developed to connect to the SCADA data base so that the methodology can be applied in online applications.

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