Fault location algorithm for four circuit transmission line employing partial differential equations

Abstract

Part of the power grid transmission lines are built in the form of a four circuits due to its small size, high population density, climatic conditions, and etc. In this Thesis, a new and accurate method for fault location in four circuit transmission lines based on Synchronous and Asynchronous Current Information and without the need for voltage information at the terminals will be presented. In this way, a transformation is first proposed, by which the differential equations governing the parallel transmission lines in the time domain are separated into independent modes and used to fault location. The methods used to fault location in four circuits transmission lines has been limited. these methods of classification method have been used that has low accuracy and only one-phase fault to the ground is investigated, or of the lumped line model is used for locating that can not provide a precise line approximation to determine the exact location of the fault, or an impedance-based method that requires an estimate of line-specific parameters and source impedances at each stage, which in practice may be error-prone. In this thesis, an analytical and precise positioning algorithm is presented in which the distributed model of the transmission line in the time domain is used and the proposed method can be applied to various types of fault and inter circuit faults. Then, a new method called the teaching-learning-based optimization algorithm will be used to solve the fault location optimization problem which one of the most important features of this algorithm is the lack of dependence on the parameters. To evaluate a proposed method, the transmission line is simulated by the EMTDC/PSCAD software and the MATLAB software is used to implement the algorithm. The results of the Fault location in different locations, incidence angles of various fault and the various resistance fault, indicate the high accuracy of the proposed method, which has a maximum absolute error of less than 0.054% using synchronous current information is independent of the various resistance and fault angles. Another important advantage of the proposed method is that it is not dependent on the type of fault, as compared with the previous fault location methods that have been provided so far in the four-circuit transmission lines. Also, maximum absolute error is less than 0.86% which indicates the high accuracy of the proposed method. The results show better performance of the TLBO algorithm compared to the harmonic search algorithm.

Key words: Fault location, Mutual Coupling, Distributed parameter transmission line model, four circuit transmission line

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Supervisor:
Dr. Mahdi Ghazizadeh Ahsaee

By:
Abotaleb Dorji

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