Accurate Fault Location in Underground Cables using Advanced Signal Processing Techniques

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Abstract

In this thesis, two power cable fault location schemes are proposed. The main advantage of the proposed schemes is solving the problem of cable changing parameters over cable age. The principle of the first proposed method is based on the successive identification of the fault generated high frequency traveling waves of the voltage signals arriving at both cable ends. The high frequency components are processed using Wavelet Transform to recognize the changes corresponding to the discontinuity points on the cable line. Correct fault position will be determined by analyzing the relationship between the characteristics of the transient sequences detected. The second adaptive fault location scheme extracts the fundamental power frequency current and voltage measurements from both end of the cable line using Discrete Fourier Transform, then estimates the fault location using the distributed line model. The method considers the line cable sections to be transposed and no assumptions were made for fault boundary conditions or fault resistance. In both proposed schemes, the processed relaying signals are the modal coordinates signals. Extensive simulation studies and results using ATP/EMTP are outlined in the thesis to demonstrate the validity of the two suggested techniques in locating faults with accepted accuracy. Both of the schemes respond very well irrespective to fault position, fault type, fault resistance, or fault inception angle. In addition, the results prove that both of the two proposed schemes solve the problem of cables changing parameters. Both of the schemes are adopted to address the problem of locating faults in aged cables in commonly system configurations: radial aged cable system, multi-end aged cable system, and aged cables combined with overhead line.

Keywords

Underground cables, Fault location, Wavelet transform,