

The stability of power system is largely affected by faults on the transmission line and time required to clear the faults. About two-third of the faults occur on transmission line network. Thus, power system stability and power quality is largely dependent on transmission line protection schemes. Quick detection of faults helps in faster maintenance and restoration of supply resulting in improved economy and reliability of power system. Multi-terminal transmission systems and transmission systems with FACTS devices play an important role to meet the increased power demand and its quality. However, these systems pose new challenges in the area of protection. Hence there is always a need to investigate into a technique based on signal processing and high-speed communication techniques to overcome the issues related to protection of modern power system.

The proposed research work aims at using Alienation based technique which utilizes wavelet based Multi Resolution Analysis of three phase current signals to detect and classify the faults. The three-phase current and voltage signals are synchronized with the help of Global Positioning System (GPS) clock. The current signals are decomposed using wavelet transform to obtain approximate coefficients over a moving window of quarter cycle. These approximate coefficients are compared with those of previous quarter cycle of same polarity to compute alienation coefficients. A fault index computed, based on these alienation coefficients, are utilized to detect and classify various transmission line faults by comparing it with pre-defined thresholds. The approximate coefficients of the current and voltage signals, of various terminals, are fed to Artificial Neural Network for location of fault precisely, from the respective terminal. The proposed algorithm has been tested successfully under the following conditions:

- Variation in fault locations
- Variation in fault incidence angles
- Variation in fault impedances
- Noise Contamination
- Varying location of FACTS devices, etc.

Various transmission systems have been considered for establishment of proposed algorithm includes:

- Two-terminal transmission system
- Multi-terminal transmission system
- Compensated transmission lines with TCSC, STATCOM and UPFC

It has been proved that the proposed technique can be successfully implemented for the transmission systems mentioned above by simulation studies.

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