Fault Detecting In High Voltage Transmission Line Based On Protection Scheme

I. INTRODUCTION

The necessity of HVDC technic a rapidly increase the efficiency of the transmission in a power system, as in the DC transmission line. The faults can easily happen in the HVDC lines because of the extremely long transmission line, high voltage and large capacity. Locating of permanent faults in transmission lines is crucial from the aspects of quick repairs and troubleshooting. In addition to permanent faults, temporary faults may occur in transmission lines, which are removed by filer. Knowing exact location of temporary faults helps identifying weak points of transmission lines and decreasing fault occurrence probability at those locations. Two types of HVDC systems are used in this day namely which is line commutated, and VSC high voltage direct current system. Definite technical and environmental advantages make HVDC transmission systems more attractive than high-voltage alternating current (HVAC) systems in many power system projects. Protection system for the HVDC transmission line often uses the voltage and its change rate to detect a ground fault in the dc line. Features used in fault locating may include information measured in one terminal or both terminals of transmission line. Two ends of transmission line generally improve fault locating accuracy, need for communication channels for transmitting information of both terminals. It is possible to use fundamental frequency or high frequency components of voltage and current signals. The high frequency components will be generated due to fault occurrence in transmission lines. The response of the transient harmonic current in the voltage source converter HVDC transmission line is analyzed under various faults. It can detect fault in external and internal side of two terminal of HVDC transmission line accurately and quickly. All of these simulations are done using MATLAB/Simulink.

II. PRINCIPLE OF VSC BASED HVDC TRANSMISSION LINE

The VSC based HVDC system is very attractive an option for bulk power transmission over long or short distances and the grid integration of renewable energy sources in existing transmission and distribution systems. The control system for both rectifier and inverter stations is to be designed using direct control methods. Design of controller’s gains at both converter stations according to transmission of active and reactive power flow in either direction is also part of the scope. Detailed studies was done regarding independent control of active, reactive power at sending and receiving ends which can be achieved using vector control strategy. The operational performance of the complete system is studied with regard to the active and reactive power variation on sending and receiving ends, DC voltage control, and harmonics reduction. The under symmetrical faults is also to be studied. By using the high frequency switching of the converter valves, the low order harmonics are reduced and the harmonic filters size can be reduced. The size of the filter and the effect of it on the system are studied. The relationship of control variables with controlled variables is also to be studied.

Fig.1. VSC Based HVDC Transmission Line
III. SINGLE PHASE TO GROUND FAULT LOCATOR

Single phase to ground fault locator is designed based on RF algorithm. In training phase, decision trees of RF fault locator are constructed based on training patterns. Each input pattern to RF is comprised of normalized values of harmonic component amplitudes of faulted phase and sound phases voltage signals. Amplitudes of harmonic components are obtained through application of DFT on one cycle of voltage signals measured at the measuring end after fault inception. After training and construction of RF trees, fault location can be acquired as output for any new patterns. The procedure of the proposed approach is presented in Fig. 5. Separate fault locators should be trained for each type of single phase faults (A-G, B-G, and C-G). It is worth noticing that the fault detection and classification are not in the scope of this paper and the time of fault signature appearance at the measuring end and the type of fault are considered as known information.

V. MATLAB SIMULATION RESULTS

VI. MODELLING OF HVDC TRANSMISSION LINE WITH FAULT.
Fault Detecting In High Voltage Transmission Line Based On Protection Scheme

VII. MATLAB SIMULATION RESULTS

VIII. MODELLING OF HVDC TRANSMISSION LINE WITH HARMONIC

XI. MATLAB SIMULATION RESULTS

X. TRANSIENT HARMONIC CURRENTS ANALYSIS

Fig. 6. MATLAB SIMULATION RESULTS

Fig. 7. MODELLING OF HVDC TRANSMISSION LINE WITH HARMONIC

Fig. 8. MATLAB SIMULATION RESULTS

Fig. 9. Transient harmonic currents analysis under an external fault at the rectifier & inverter side. The transient harmonic current protection unit of the HVDC transmission line resides in the relays M and N in Fig. 1 and the two relays are taken as a
Fault Detecting In High Voltage Transmission Line Based On Protection Scheme

85