

Title: DC Fault Detection Method and Clearance in VSC-HVDC system

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Abstract:

Today's electric grid is mostly based on alternating current (AC), as well as the loads. The advancement of voltage source converter (VSC) has paved way for the emergence of VSC-HVDC transmission system opening up the possibility to build a multi-terminal HVDC grid. For this reason, DC grid is an important technology that deserves consideration, but there are a lot of open points to be answered. One of the critical topics for such DC grid is the protection.

In this thesis, three fault detection methods are proposed. The first method involves wavelet transform. Because the DC fault can happen anytime and is unpredictable, the signal processing technique can work on the non-stationary fault signal and identify the presence of high frequency content caused by fault. The second method is to monitor the behaviour of DC-link capacitor in VSC. In the event of fault, the DC-link capacitor will discharge contributing to high fault current. The third method uses short-time Fourier transform (STFT). It will be studied how the distortion in frequency spectrum shows the indication of DC fault occurrence. These methods are able to detect the fault within 1 ms and differentiate DC fault from external fault. The simulation model is built in PSCAD/EMTDC, supported by the results from scaled-down DC experimental hardware.

It is also equally important to address the issue of fault clearance in DC system. This thesis will discuss and analyse three protection schemes. Each scheme will be assessed based on how fast they clear the fault and achieve smooth recovery. For this study, it is entirely done in PSCAD/EMTDC.