STUDIES OF FAULT CURRENT LIMITERS FOR POWER SYSTEMS PROTECTION

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To my parents:

Balbir Singh Malhi

and

Paramjit Kaur Malhi

ABSTRACT

In today's technological world, electrical energy is one of the most important forms of energy and is needed directly or indirectly in almost every field. Increase in the demand and consumption of electrical energy leads to increase in the system fault levels. It is not possible to change the rating of the equipment and devices in the system or circuits to accommodate the increasing fault currents. The devices in electronic and electrical circuits are sensitive to disturbance and any disturbance or fault may damage the device permanently so that it must be replaced. The cost of equipment like circuit breakers and transformers in power grids is very expensive. Moreover, replacing damaged equipment is a time and labour consuming process, which also affects the reliability of power systems. It is not possible to completely eliminate the faults but it is possible to limit the current during fault in order to save the equipment and devices in the circuits or systems. One solution to this problem is to use a current limiting device in the system. There are many different types of approaches used for limiting fault currents

Two different approaches to limit fault currents have been discussed by the author. One is Passive Magnetic Current Limiter (MCL) and another is High Temperature Superconductor Fault Current Limiter (HTSFCL). Both are passive devices and they do not need any sensor or external sources to perform their current limiting action. The first device consists of two ferrite cores and a permanent magnet which is sandwiched between the two saturated cores and it is called Magnetic Current Limiter. Experimental results with the MCL in circuit are discussed. Both field and thermal models of the MCL have been simulated using finite element software, FEMLAB.

The demonstration of the High Temperature Superconductor Fault Current Limiter (HTSFCL) in power systems has been explained. The MATLAB simulation of the HTSFCL has been done and the results with and without the fault are shown. Power System Analysis Toolbox (PSAT) software has been used to locate the optimum or the best location of HTSFCL in a nine bus system. It has been shown that it is possible to find a solution that limits the fault current in power systems. Depending on the size of the system, either the MCL or the HTSFCL can be implemented. The location of the HTSFCL is to be carefully selected to achieve optimum results.

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