FEASIBILITY STUDY OF AN APPLICATION OF A SATURATED MAGNETIC CORE AS A FAULT CURRENT LIMITER

P.J. BINDUHEWA, J. R. S. S. KUMARA, A.ATPUTHARAJAH, J. B. EKANAYAKE

Department of Electrical and Electronic Engineering, University of Peradeniya, Sri Lanka

ABSTRACT

The connection of new generators and abnormal operations of the power system increase the fault current over the rating of the electrical equipment in distribution and transmission networks. Different types of Fault Current Limiters (FCL) can be used to limit the fault current. This paper presents a feasibility study of an application of a saturated magnetic core as a FCL. The operating principles that govern an application of saturated core as a FCL is presented. Then a prototype FCL was designed, implemented and tested in reduced voltage and current conditions. The results obtained from the test shows excellence performance of the device in both normal and fault conditions. In order to investigate the feasibility of the device, a FCL was designed for a real distribution network using above technique.

1. INTRODUCTION

Due to connection of new generators and abnormal operations of power systems, such as switching transients, faults and surges, high currents can be generated. Normally, the fault current level is much higher than the normal operating current and immediate steps should be taken to clear the fault or limit the fault current. If the fault current becomes excessively large, transmission lines and associated equipment can be damaged. Under these circumstances, some times the fault current may increase beyond the rating of the switchgear thus demanding a replacement. However replacement of existing switchgear is very expensive and alternative solutions ought to be investigated. One of the possible solutions is to use a fault current limiter (FCL), which will reduce the fault current to an acceptable limit. An FCL shows very low impedance during the normal operation while showing higher impedance during a fault.

A number of different types of fault current limiters namely, superconductor fault current limiters, reactor type fault current limiters and magnetic fault current limiters are published in literature [1,2,3,4]. Even though superconducting fault current limiters are dominating, major disadvantage of this type of FCL is its high cost. In the case of magnetic FCLs, typically a saturated core is used to control the fault current. Most of the published literature presents such an FCL with a permanent magnet in the iron core [5,6].

This paper presents a feasibility study of a magnetic FCL that use a dc supply to saturate the iron core. Two coils are wound in the core, where one of them is used to saturate the core via an external dc supply and the other coil is connected in series with the ac line. A laboratory prototype is constructed and theory developed is extended for a real application. Possibility of using the ac voltage at the point of connection for saturating the core is also explored.