

Analysis and Control of Fault Current by Firing Angle Control of Solid State Fault Current Limiter

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Abstract—In present scenario of power system, rapid development of power network increase fault current at a level that will affect the system security, stability and reliability. For many existing power system equipments of power system, fault current have exceeded from their withstand capacity. Hence, limiting the fault current to a safe level may reduce failure rate of power system equipment and maintenance cost of the system. This problem is greatly reduced by the use of solid state fault current limiter (SSFCL). The test system is a practical express distribution feeder, Bajaj hospital. In this paper, impacts of firing angle associated with SSFCL control system for symmetrical and unsymmetrical faults are investigated. From results, it is observed that increasing the firing angle leads a reduction in first peak of the fault current.

Keywords—Solid state faults current limiter, Short Circuit Current, Fault, Power Quality, Firing angle

I. INTRODUCTION

One of the main concerns cognate with perpetual magnification of electricity demand is associated incremented short circuit fault level. This matter has been discussed since early 1960s, several solutions predicated on different principles have been suggested and implemented. Over the last four decades, variants of fault current limiter (FCL) have been under the spotlight in power protection research. In recent years, different types of FCL have been proposed and developed in many countries. Mainly two types of FCL are discussed. One is superconductor fault current limiter (SFCL) and other one is solid state fault current limiter (SSFCL). This interest comes not just due to their excellent current constraining characteristics but withal due to their positive contribution to supply quality. FCLs can be efficacious in reducing supply outage and mitigate voltage sag on power network.

Because of perpetual magnification of voltage sensitive loads, voltage sag is becoming consequential quandary to distribution companies. IEEE standard define voltage sag as a decrementation in rms voltage from 90% to 10% of nominal value for a time more preponderant than 0.5cycles of the power frequency but less than or identically tantamount to one minute[1][2][3]. Above sensitive loads are mainly process plants, electronic equipments and automatic control systems. It is observed by distribution companies that voltage sags are caused by the malfunctioning or failure of above sensitive loads for radial feeders [5][6], which leads to financial losses.

The proposed SSFCL [1] was tested on a practical express distribution feeder, Bajaj hospital in a MATLAB/SIMULINK environment. This paper is extension work of reference [1]. It investigates the effect of incrementing the firing angle of the SSFCL control system on the faulty bus and point of coupling (PCC) bus of a practical express distribution feeder, Bajaj hospital [1][8].

II. PROPOSED SOLID STATE FAULT CURRENT LIMITER

A Fault Current Limiter (FCL) is used to limit the prospective fault current and connected in series with a circuit. FCL provides very low impedance during normal operating condition and high impedance under fault conditions [1].

Each thyristor branch has two thyristor connected in inversely parallel and current limiting reactor also connected in series with thyristor branch 2. Thyristor branch 1 is mundanely closed and conducts current in normal conditions [1, 9, 10]. Nevertheless, when the magnitude of the current exceeds a pre-set level, the thyristor branch 1 will open the circuit instantly interrupts the current flow and thyristor branch 2 facilitate path to above fault current [1]. A surge arrester, which is designed for high energy absorption is withal placed in parallel with these two branches [9] to forfend the system from voltage surge during this transition.

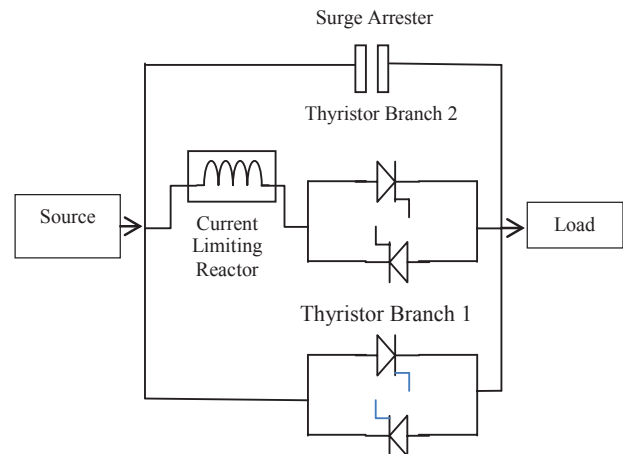


Fig. 1. Basic arrangement of solid-state FCL [7]

Proposed SSFCL have two blocks such as solid state fault current limiter and control system block. Fault current limiter