

Ground Short Circuit Contributions of a MV Distribution Line Equipped with PWMSC

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Abstract : This paper proposes a new approach for the calculation of short-circuit parameters in the presence of Pulse Width Modulated based Series Compensator (PWMSC). PWMSC is a newly Flexible Alternating Current Transmission System (FACTS) device that can modulate the impedance of a transmission line through applying a variation to the duty cycle (D) of a train of pulses with fixed frequency. This results in an improvement of the system performance as it provides virtual compensation of distribution line impedance by injecting controllable apparent reactance in series with the distribution line. This controllable reactance can operate in both capacitive and inductive modes and this makes PWMSC highly effective in controlling the power flow and increasing system stability in the system. The purpose of this work is to study the impact of fault resistance (RF) which varies between 0 to 30 Ω on the fault current calculations in case of a ground fault and a fixed fault location. The case study is for a medium voltage (MV) Algerian distribution line which is compensated by PWMSC in the 30 kV Algerian distribution power network. The analysis is based on symmetrical components method which involves the calculations of symmetrical components of currents and voltages, without and with PWMSC in both cases of maximum and minimum duty cycle value for capacitive and inductive modes. The paper presents simulation results which are verified by the theoretical analysis.

Keywords : pulse width modulated series compensator (pwmsc), duty cycle, distribution line, short-circuit calculations, ground fault, symmetrical components method

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