The Effect of Capacitor Switching on Power System Performance

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Abstract

Power system components are exposed to transient oscillations of voltages and currents produced by energizing and de-energizing devices. These transients may be short-lived, but they have high peak values and frequencies much greater than the power system fundamental frequency. In this thesis, we study the switching of capacitor banks which result in high transient voltage and current. These can create problems at the power system performance. The applications of pre-insertion impedance or using Zero Crossing switching with the capacitor bank switching device can control the voltage and current transients and thus mitigate these problems. ATP (Alternative Transient Program) is used for digital simulation of transient electromagnetic phenomena. I investigate the effects of these transients on the power system components such as transmission lines and cables, compare them in some cases such as: In Line: calculate the values of natural frequencies and inrush currents they are high in the case of Back-To-Back Switching in the transient period so transient overvoltage will expose the line effects on the power system performance, by increasing value of two capacitor banks the oscillations decrease and overvoltage on the line increase. Used two methods to prevent these oscillatory transients to protect the power system performance: Insert pre-insertion resistor before the capacitor bank energization or Zero crossing switching. In Cable: because the increase of the capacitance for cables than transmission lines the transient overvoltage that exposed to cables very high which effect on power system performance, to prevent this problem studied the same solution for transmission lines and by increasing value of two capacitor banks the oscillations decrease and overvoltage on the cable decrease.

Keywords

Transient Oscillations, Inrush Current, Natural Frequency,