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Distance Protection Behavior of Transmission Lines Equipped with Series Compensation Capacitors using Matlab

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ABSTRACT

In order to meet the high demand for power transmission capacity, some power companies have installed series capacitors on power transmission lines. This allows the impedance of the line to be lowered, thus yielding increased transmission capability. Series capacitor makes sense because it's simple and could be installed for 15 to 30% of the cost of installing a new line, and it can provide the benefits of increased system stability, reduced system losses, and better voltage regulation. Protective distance relays, which make use of impedance measurements in order to determine the presence and location of faults, are "fooled" by installed series capacitance on the line when the presence or absence of the capacitor in the fault circuit is not known a priori. This is because the capacitance cancels or compensates some of the inductance of the line and therefore the relay may perceive a fault to be in its first zone when the fault is actually in the second or third zone of protection. Similarly, first zone faults can be perceived to be reverse faults! Clearly this can cause some costly operating errors. The general approach of interest is a method leading to the determination of the values of series L and C of the line at the time of the fault. This is done by analyzing the synchronous and sub-synchronous content of the Volt and current signals separately which provides adequate information to compute the series L and C of the line. In this paper calculated Z impedance transmission line $Z(f)$ as function of frequency and draw it with characteristic of relay and studied effect of series compensation capacitor to protection of line. The proper operation of the distance protection relay has also been demonstrated.

Keywords. Distance protection relay, transmission line, Series Compensation Capacitors.