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A Series Arc Fault Location Method for DC Distribution System Using Time Lag of Parallel Capacitor Current Pulses

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As DC distribution system is developing rapidly, DC series arc fault has become a severe threat to safe operation of DC systems, since DC arc cannot extinct by itself. Moreover, DC series arc fault is difficult to be located, as the high frequency components of the arc current that are superimposed on the normal DC current cannot be extracted in some cases.

In this paper, a DC series arc fault location method is proposed by using time lag between parallel capacitor current pulses at both ends of the DC cable. Capacitors are utilized to couple the high frequency current that can indicate the presence of the arc fault and avoid the interference of normal DC current. High frequency current arrives at two capacitors paralleled with the cable ends at different time when series arc fault occurs in the cable. The arriving time of the fault current pulse can be accurately determined by using the rising edge of the pulse. Thus, the time lag can be used to locate the arc fault.

Models of DC distribution system with different cable configurations are built in PSCAD. Then DC arc test platform is constructed consisting of DC power supply, cables (300 m) and load. Capacitors are parallel with the two ends of the cables. Rogowski coils are adopted as the capacitor current sensors in the system, and bandwidth of the coils is from 100 Hz to 1000 kHz, according to the characteristics frequency band of the fault capacitor current. The arc faults are generated at different locations.

For arc faults at different locations, the largest location error is less than 15 m. The test results indicate that the proposed method can locate DC series arc fault accurately.

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