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Wed-Mo-Po3.09-07 [69]: Electromagnetic field analysis of resistive superconducting fault current limiters for DC applications

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With the development of DC power supply systems, breaking capacity of circuit breakers has been increasingly unable to meet the growing requirements for DC system short-circuit current level. To ensure the safety of the systems, a fault current limiter must be used in series with circuit breakers. The properties of superconducting fault current limiters such as fast reaction rate, simple structure, small size have caused widespread concern, the research on superconducting fault current limiters is becoming a hotspot in the field of DC system protection.
In the paper, a transient FEM computational model of resistive superconducting fault current limiters is established. Using the model, the transient magnetic field distribution and the inductance of superconducting coils, and the electromagnetic force on the coils are calculated. Based on the transient FEM computational model of the electromagnetic field, the field-circuit combination method is used to calculate the current and voltage in the coil of the resistive superconducting fault current limiter, and the influence of temperature on them when a short circuit occurs in the power system. Using the results of theoretical calculation, the short-circuit characteristics of resistive superconducting fault current limiters with different structures and geometries are studied.
In addition, an experimental model of resistive superconducting current limiters, which is used to verify field calculation results, is developed, and the relevant data are measured.
The results of the paper can be used for performance analysis and optimization design of resistive superconducting current limiters.

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