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Evaluation of Voltage between Conductors for Resonance Phenomenon and Transient Response in JT-60SA Central Solenoid

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The central solenoid (CS) of JT-60SA is composed of the four electrically independent modules, and 6 octa-pancake coils and a quad-pancake coil are assembled vertically in one module. The CS module is supplied with current through the room temperature busbar and current feeder of the superconductor. The withstand voltage for the insulation between the conductors is one of the most important parameters for the magnet system. The maximum voltage between the CS module terminals is designed to be 10 kV, the voltage between the layers under ideal conditions is then about 0.38 kV because the CS module has 52 layers. The actual voltage between the conductors can become lager than the voltage under ideal condition due to the resonance phenomenon and transient response to supply voltage. Therefore, there is a possibility that the insulation between conductors is damaged. In the previous works, from the experimental and analytical results of the real size preproduction quad pancake coil, the circuit simulation model of the 12-layer pancake coil that is part of JT-60SA CS was created, and the influence of resonance phenomenon on voltage distribution was investigated. Based on the results of the previous works, the circuit simulation model of the CS module (the 52-layer pancake coil) was created. Moreover, the circuit simulation model includes the room temperature busbar, the current feeder and the structures around the CS module. We evaluated the behavior of the voltage between conductors for resonance phenomenon and the transient response to the supply voltage in the CS module by using the simulation model. As a result, it can be concluded that the influence of resonance phenomenon and transient response is negligible small under the operating conditions. These results therefore represent important information for the safe operation of the JT-60SA.

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