

Quasi-3D thermal-hydraulic analysis and test result of the cool-down for CFETR CSMC

Wednesday 11 June 2025 14:35 (1 minute)

The cool-down of large-scale Cable-in-Conduit Conductor (CICC) superconducting magnets presents significant complexity, requiring careful management to ensure operational safety. This study proposes a quasi-three-dimensional thermal-hydraulic analysis model, specifically designed for large-scale CICC superconducting magnets. The model is applied to the cool-down (300 K-80 K) for the Central Solenoid Model Coil (CSMC) of China Fusion Engineering Test Reactor (CFETR). It is capable of successfully constraining the maximum temperature differential among the various components of the magnet while providing an accurate depiction of the temperature distribution throughout the cool-down. The analysis results correlate remarkably well with the experimental findings. The results offer valuable theoretical insights for future cooling experiments, thereby helping to mitigate the risk of damage to the magnet due to inappropriate cooling parameters.

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Session Classification: Posters

Track Classification: Magnets