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H4C analysis of quench propagation experiments in HTS Cable-In-Conduit Conductors

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An extensive experimental campaign, supported by the EUROfusion consortium, is ongoing at SULTAN to investigate the quench propagation in High Temperature Superconducting (HTS) Cable-In-Conduit Conductors (CICCs) and provide support for the calibration and validation of the numerical tools used for the analysis of quench propagation in HTS CICCs.
The H4C code (an upgraded version of the 4C code - a state-of-the-art numerical tool for the analysis of thermal-hydraulic transients in Low Temperature Superconducting CICCs and coils) was recently developed at Politecnico di Torino to analyze fast thermal-hydraulic and electric transients, such as the quench, in HTS CICCs.
In this work, the H4C model of the CICCs already tested in SULTAN, i.e., different designs proposed by the SPC team, is developed. The analysis of the data collected in both DC and quench tests, which are functional for constructing the input of the model, is reported first. Then the calibration of the thermal-hydraulic and electric interface parameters, such as the heat transfer coefficient among the different conductor elements and between them and the forced-flow He, is discussed. Eventually, after freezing the parameters tuned through the calibration, the validation of the model is carried out by comparing the computed voltage and temperature evolutions (up to the current dump) with the data measured at different positions along the conductor.

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Category

Quench experiment, simulation and analysis for all classes of LTS and HTS magnets

Keywords

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