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Thu-Mo-Po.08-03: [Invited] IntelliMIK: A Novel Intelligent Quench Detection Method for HTS in Fusion Devices

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High-temperature superconducting (HTS) magnets are designated for use as Central Solenoid (CS) magnets in China's next-generation fusion device. However, their temperature rises rapidly when quenching happens, which may lead to performance degradation. So the voltage detection threshold of HTS is much lower than LTS magnets. The currently employed Co-wound Wire (CWW) + Inductive Noise Realtime Calculation (MIK) voltage detection method on the EAST device can not reduce voltage noise below the detection threshold required for HTS magnets. To solve this problem, we proposed a voltage detection method called IntelliMIK, which is based on the combination of CWW technology and deep learning. It was tested on the EAST device, and the experimental results demonstrate that the detection accuracy is improved by 90%, and the quench detection time is advanced by 500 ms. Simulation analysis and experimental verification further confirm that this method can accurately identify quenches at the early stage, thereby ensuring the safe and stable operation of HTS magnets in China's next-generation fusion device. IntelliMIK provides an innovative solution for quench detection of HTS magnets. It not only draws on the mature experience of traditional voltage detection methods but also achieves faster response speed through technical improvements. It has important application value and provides new ideas for the monitoring and maintenance of superconducting magnets in the future.

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