

Monitoring Electrical and Thermal Characteristics of HTS Cable Systems via Time-Frequency Domain Reflectometry

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Abstract— A HTS cable system with the 22.9 kV, 50 MVA, and 410 m length is installed and operated at 154 kV Icheon substation of Korea Electric Power Corporation (KEPCO). Unfortunately, it is a difficult task to diagnose and monitor electrical and thermal characteristics of the HTS cable system in a real-time manner. In order to protect operational failures of grid-connected HTS cable systems, this paper proposes a time-frequency domain reflectometry (TFDR) and analysis techniques, i.e., time-frequency cross-correlation and instantaneous frequency (IF) estimation. To verify the performance of the proposed method, the temperature is changed via cryogenic refrigeration system, and the status of grid-connected HTS cable is monitored via TFDR in a real-time manner.

Keywords (Index Terms)— High-temperature superconducting (HTS) cable systems, instantaneous frequency (IF), joint box, time-frequency domain reflectometry (TFDR), Wigner-Ville distribution.

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