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Thu-Mo-Po4.12-01 [88]: Mobile Superconducting Magnetic Energy Storage for On-site Estimations of the Electric Power System Stability

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Photovoltaic power generation and wind power generation are important renewable energy sources in the present power system. However, since these power generations are interconnected to the power system through power converters, the interconnection of large amount of renewable energy sources leads to lower the power system stability due to the lack of the inertial energy of conventional synchronous generators in the power system. The objective of this work is to discuss the feasibility of superconducting magnetic energy storage (SMES) in order to estimate the electric power system stability. SMES has higher response power control capability with a less than second order of the charge/discharge cycle. From this feature, SMES can be expected to identify the eigenvalue which expresses an oscillation mode of the power system. However, since the oscillation mode of the power system varies in real time, the SMES equipment requires the mobility and the weight saving for the on-site identification of the eigenvalue. To overcome this technical challenge, the authors propose the concept of force-balanced coils (FBCs) which are composed of helically coil windings and minimize the required mass of the structure for the SMES coils. In this work, the authors carry out a design study on a MJ class SMES equipment whose components such as SMES coils, refrigerators and power converters are installed in a 40-feet dry container. For the further weight saving of the SMES equipment, the authors focus on the feasibility of MgB2 wires which have the lowest mass density compared with the other types of conventional superconductors. The authors investigate the engineering feasibility of the mobile SMES equipment for the on-site estimations of the electric power system stability.
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