Contribution ID: **1099** Contribution code: **THU-PO3-LN2-13** Type: **Poster**

State predictive control of modular SMES magnet based on deep reinforcement learning

Thursday, 18 November 2021 10:00 (2 hours)

Superconducting Magnetic Energy Storage (SMES) has the characteristic of fast response and high power density, which can be used to enhance the stability of power system and improve the power quality. With the increasing capacity of the power system, the application of a single SMES has certain limitations. By integrating individual superconducting magnet unit or SMES unit, modular SMES (M-SMES) with high reliability and strong scalability will become an important structural form of SMES. However, in the process of dynamic power compensation of the M-SMES, the AC loss and eddy current loss caused by the current change will increase the temperature of the superconducting magnet, thus affecting its thermal stability. Therefore, the analysis of the thermoelectric dynamic characteristics of SMES magnets is a complex nonlinear problem involving multi-parameter and multi-time-scale interactions. With the vigorous development of artificial intelligence technology, deep reinforcement learning (DRL) algorithms have emerged. DRL is a kind of data-driven algorithm with strong perceptual ability and decision-making ability, and is applicable for sequence control problems. In this paper, a DRL based M-SMES magnet state predictive control is proposed to solve the problem of the thermal stability of the magnet during the dynamic operation of SMES. Firstly, the interaction between temperature, current, state of charge and other parameters is comprehensively analyzed, and a state database of SMES magnet is established. Then, based on the real-time state and the compensation demand on the grid side, a DRL algorithm is adopted to predict the magnet state and coordinately control each SMES module, which aims at maximizing the compensation capability of the M-SMES within a safe range. Finally, through a case study of M-SMES in the micro grid under different operation modes, the effectiveness of the proposed method is verified.

Primary authors: ZHANG, Zitong (Huazhong University of Science and Technology); SHI, Jing (Huazhong University of Science and Technology); GUO, Shuqiang (Huazhong University of Science and technology); LIN, Dengquan (Huazhong University of Science and Technology)

Presenter: ZHANG, Zitong (Huazhong University of Science and Technology)

Session Classification: THU-PO3-LN2 Late News II

Track Classification: E: Magnet Technology for Power, Energy, Transport, and other Applications: E03 SMES, Superconducting Transformers and Fault Current Limiters