Event-Triggered Consensus Control of P2HH-Based Integrated Energy Systems with Two-Time Scales

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Abstract. In this paper, an event-triggered consensus control strategy is designed to realize the consensus of a Power to Heat and Hydrogen (P2HH)-based integrated energy system with two-time scales. The coupling of different energy sources and the characteristics of multi-time scales in the P2HH-based integrated energy system may cause instability or inefficiency in the control process. To solve this problem, first, using the singular perturbation theory, the two-time scales system is decoupled into the fast and slow dynamics to find the control gain. Then, an event-triggered mechanism is proposed to independently determine the information transfer moments for the slow and fast dynamics of the system. Meanwhile, the P2HH-based integrated energy system is mathematically modeled. In order to achieve the consensus of indoor temperature and generator angular velocity, the designed consensus protocol is applied to the P2HH-based integrated energy system. It is demonstrated that the designed protocol can realize the consensus of the P2HH-based integrated energy system. Finally, simulations validate the designed control strategy, even if the topology is changed.

Keywords: Two-time scales, event-triggered control, Power to Heat and Hydrogen (P2HH), integrated energy system