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A Reinforcement Learning Based Method for Heating, Ventilation, and Air Conditioning Demand Response Optimization Considering Few-Shot Personalized Thermal Comfort

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Abstract : The reasonable operation of heating, ventilation, and air conditioning (HVAC) is of great significance in improving the security, stability, and economy of power system operation. However, the uncertainty of the operating environment, thermal comfort varies by users and rapid decision-making pose challenges for HVAC demand response optimization. In this regard, this paper proposes a reinforcement learning-based method for HVAC demand response optimization considering few-shot personalized thermal comfort (PTC). First, an HVAC DR optimization framework based on few-shot PTC model and DRL is designed, in which the output of few-shot PTC model is regarded as the input of DRL. Then, a few-shot PTC model that distinguishes between awake and asleep states is established, which has excellent engineering usability. Next, based on soft actor criticism, an HVAC DR optimization algorithm considering the user's PTC is designed to deal with uncertainty and make decisions rapidly. Experiment results show that the proposed method can efficiently obtain use's PTC temperature, reduce energy cost while ensuring user's PTC, and achieve rapid decision-making under uncertainty.

Keywords : HVAC, few-shot personalized thermal comfort, deep reinforcement learning, demand response
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