Iterative Learning Control Guided Reinforcement Learning Control Scheme for Batch Processes

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Abstract

Iterative learning control (ILC) offers an effective learning control scheme to solve the control problems of the batch processes. Although the control performances of ILC systems can be improved batch-by-batch, the convergence still strongly depends on the repeatability of the process and thus lack of robustness. Meanwhile, the data-driven-based deep reinforcement learning (DRL) algorithms have good robustness due to the generalization of the neural network, but it has lower data efficiency in training. In this paper, we propose a complementary control scheme for the batch processes by employing a DRL guided by a classical ILC, termed as the IL-RLC scheme. This scheme has higher data efficiency than the DRL without guidance and better robustness than the ILC, which are demonstrated by the numerical simulations on a linear batch process and a nonlinear batch reactor. This work provides a way for the application of DRL algorithm in the batch process control.

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