Optimal Adaptive Controller Design for Unknown Linear Systems
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ABSTRACT
In this work, the optimal adaptive control design with finite-horizon is presented for discrete-time linear systems with unknown system dynamics. Q-learning scheme is utilized while an adaptive estimator is proposed to learn the Q-function such that the system dynamics are not needed. The time-varying nature of the solution to the Bellman equation is handled by utilizing a time-dependent basis function and the terminal constraint is incorporated in the novel update law for solving the optimal feedback control. The proposed optimal regulation scheme of the uncertain linear system yields a forward-in-time and online solution without using policy and/or value iterations. For the time invariant linear discrete-time systems, the closed-loop dynamics of the finite-horizon regulation problem becomes essentially non-autonomous and involved, but verified by using standard Lyapunov stability theory. Simulation results are shown to verify the effectiveness of the proposed method.

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