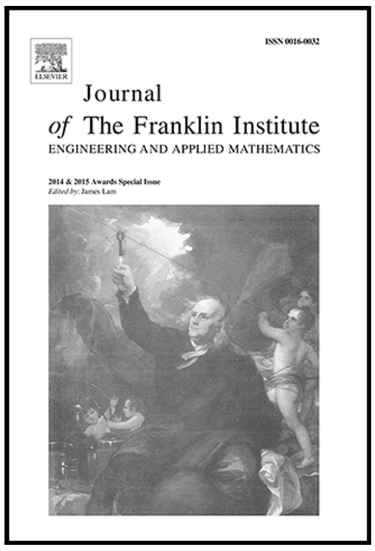

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Online Adaptive Policy Iteration Based Fault-Tolerant Control Algorithm for Continuous-Time Nonlinear Tracking Systems with Actuator Failures

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Abstract

In this paper, a novel tracking control scheme for continuous-time nonlinear affine systems with actuator faults is proposed by using a policy iteration (PI) based adaptive control algorithm. According to the controlled system and desired reference trajectory, a novel augmented tracking system is constructed and the tracking control problem is converted to the stabilizing issue of the corresponding error dynamic system. PI algorithm, generally used in optimal control and intelligence technique fields, is an important reinforcement learning method to solve the performance function by critic neural network (NN) approximation, which satisfies the Lyapunov equation. For the augmented tracking error system with actuator faults, an online PI based fault-tolerant control law is proposed, where a new tuning law of the adaptive parameter is designed to tolerate four common kinds of actuator faults. The stability of the tracking error dynamic with actuator faults is guaranteed by using Lyapunov theory, and the tracking errors satisfy uniformly bounded as the adaptive parameters get converged. Finally, the designed fault-tolerant feedback control algorithm for nonlinear tracking system with actuator faults is applied in two cases to track the desired reference trajectory, and the simulation results demonstrate the effectiveness and applicability of the proposed method.

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