Scalability of Closed-Loop System Responses in Adaptive Control Schemes

Although adaptive control offers a unique way to control dynamical systems without excessive reliance on their mathematical models, it is well known that nonidentical command profiles result in nonidentical closed-loop responses with such controllers, and therefore, it is of practical interest to study theoretical ways to construct predictable closed-loop responses when adaptive controllers are in the loop. To that end, we introduce a new concept called scalability to adaptive control in this paper. In particular, we analyze how to scale learning rates of adaptive weight update laws of various adaptive control schemes with respect to given command profiles to achieve a predictable closed-loop response. Illustrative numerical examples are provided to demonstrate the proposed concept and a possible utilization for the evaluation of adaptive controllers.