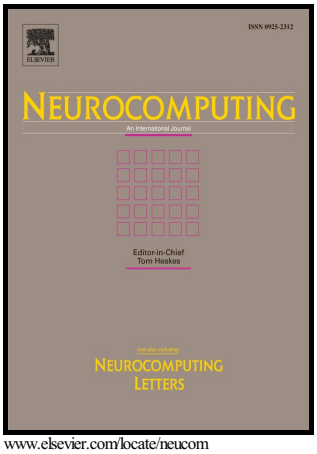

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Reduced-order observer-based adaptive fuzzy tracking control for chaotic permanent magnet synchronous motors

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Abstract

This article studies an adaptive fuzzy control method combined with reduced-order observer technology for the position tracking control of chaotic permanent magnet synchronous motor (PMSM) drive system. Fuzzy logic systems (FLSs) are introduced to solve the problem of nonlinear and unknown functions appeared in the PMSM drive system, reduced-order observer is used to calculate its angle speed. Meanwhile, adaptive backstepping mechanism is applied for the design procedure of controllers. The control technique developed in this paper can ensure that the tracking error falls into a small neighborhood of origin. Compared with the existing results, the proposed algorithm can solve the explosion of complexity issue and it does not require measuring the speed signal of motors and the number of adaptive parameters has been reduced to only one. Simulation results show that the chaos of PMSM can be successfully suppressed by the proposed method and the system can track the reference signals very well.

Keywords: Fuzzy approximation; Reduced-order observer; Backstepping; Permanent magnet synchronous motor

1 Introduction

Recently, the study of chaotic control has drawn great interests due to its significant value in engineering, physics, mathematics and biology fields. With Ott et al. [1] proposing a control method in chaotic dynamic system in the early 1990s, many techniques have been developed for controlling different chaotic systems including