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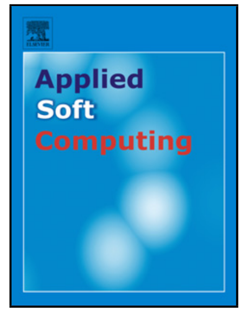

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Adaptive inverse position control of switched reluctance motor

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Abstract

In this paper, adaptive inverse position control is applied to switched reluctance motor (SRM) with simplified interval type-2 fuzzy neural networks (SIT2FNNs). The proposed adaptive inverse position control scheme for the SRM can be divided into the design of two control loops. The first loop is used for the position control, which is designed based on the adaptive inverse control (AIC). And the AIC is constructed with two SIT2FNNs, which are applied to identification and control for the SRM, respectively. The second loop is used for the current control, which is realized with the current-sharing method (CSM). Simulation results certify the effectiveness of the proposed control scheme in the achievement on high position control precision and perfect dynamic performance for the SRM.

Key words: Switched reluctance motor, Adaptive inverse control, Position control, Simplified interval type-2 fuzzy neural networks, Current-sharing method

1. Introduction

Switched reluctance motors (SRMs) are essentially different from induction motors (IMs) and permanent magnet synchronous motors (PMSMs) in working principles [1,2]. The rotor of the SRM need not any permanent magnet or windings. Although the SRMs have lots of merits, such like rugged structure, low cost and intrinsic simplicity. The doubly salient structure and high magnetic saturation make the SRMs have strong nonlinearities [3,4]. Large torque ripple and acoustic noise of the SRMs confine their application areas. At present, the application areas of the SRMs are mainly concentrating on the occasions that need speed or torque control [5,6]. The SRMs are not a popular choice for the driving system that requires high performance position control. And there are very few literatures that foucs on the position control of the SRMs [7-15]. Although there exist many difficulties that prevent the application of the SRMs in the position control, the SRMs still have enormous potentialities in the occasions of the position control. The researches on the position control of the SRMs are very meaningful.

In recent years, a few strategies were applied to the position control of the SRMs. Reference [7] applied the backstepping to the position tracking control of the SRM, where the proposed controller need the full state measurement (i.e. position, speed and phase current). The backstepping design depended strongly on the nonlinear model of the SRM. Reference [8] developed an adaptive backstepping controller for the position tracking control of the SRM. The proposed controller required the general flux model of the SRM. Reference [8] utilized three control loops (position, speed and current) to realize the high performance position control of the SRM. The switching angle controller was constructed by 2-D lookup table which was predetermined from the optimal turn-on and turn-off angle according to the torque and speed characteristics. Reference [10,11] adopted the gain-scheduling regulator to realize the high-performance position control of the SRM. The controller depended on the structure and electrical

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