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电源学报 >> 2022, Vol. 20 >> Issue (3) : 126-132. DOI: 10.13234/j.issn.2095-2805.2022.3.126

电力传动与变频调速

基于扩展卡尔曼滤波的无速度传感器无刷双馈感应电机直接转矩控制

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Speed Sensorless Direct Torque Control of Brushless Doubly-fed Induction Machine Based on Extended Kalman Filter

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History

摘要

本文提出了一种基于扩展卡尔曼滤波的无速度传感器无刷双馈感应电机直接转矩控制策略。通过对三相无刷双馈感应电机在转子速度坐标系下的数学模型进行分析,推导出系统的状态方程和观测方程,实现基于扩展卡尔曼滤波算法的转子速度和功率及控制绕组磁链的估计。根据磁链的估计值计算出电磁转矩,并通过对控制绕组磁链进行定向和逆变器开关状态的判定实现无刷双馈感应电机的转矩控制。仿真结果表明,在速度给定阶跃变化、负载突变的情况下,所提控制策略均能实现对转速和磁链的精确估计,系统运行稳定。

Abstract

In this paper, a speed sensorless direct torque control strategy for a brushless doubly-fed induction machine(BDFIM) based on extended Kalman filter(EKF) is proposed. By analyzing the mathematical model of a three-phase BDFIM under a rotor speed coordinate system, the state and observation equations of the system are derived, thus realizing the estimations of rotor speed, power, and control winding flux linkage based on the EKF algorithm. According to the estimation of flux linkage, the magnitude of electromagnetic torque is calculated, and the direct torque control of BDFIM is realized by determining the orientation of control winding flux and the inverter's switching state. Simulation results show that when a step change in speed and a sudden change in load occur, the proposed control strategy can achieve accurate estimations of speed and flux linkage, and the system can run stably.

关键词

无刷双馈感应电机;无速度传感器;扩展卡尔曼滤波;直接转矩控制

Key words

brushless doubly-fed induction machine(BDFIM);speed sensorless;extended Kalman filter(EKF);direct torque control

引用本文

导出引用

郑诗程, 周甜军, 郎佳红. 基于扩展卡尔曼滤波的无速度传感器无刷双馈感应电机直接转矩控制. 电源学报. 2022, 20(3): 126-132. <https://doi.org/10.13234/j.issn.2095-2805.2022.3.126>

ZHENG Shicheng, ZHOU Tianjun, LANG Jiahong. Speed Sensorless Direct Torque Control of Brushless Doubly-fed Induction Machine Based on Extended Kalman Filter. *Journal of Power Supply*. 2022, 20(3): 126-132. <https://doi.org/10.13234/j.issn.2095-2805.2022.3.126>

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基金

安徽省自然科学基金重点资助项目 (KJ2017A044)



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