

一种线性卡尔曼滤波的并网逆变器的自适应准PR控制器

娄一川, 梁理程, 杨浩, 滕毅遥, 宋国杰, 陈延明

作者信息

Adaptive Quasi-PR Controller for Grid-connected Inverter Based on Linear Kalman Filter

LOU Yichuan, LIANG Licheng, YANG Hao, TENG Fuyao, SONG Guojie, CHEN Yanming

Author information

History

摘要

弱电网条件下存在电网频率偏移, 使用固定参数的准PR控制器会导致控制性能下降, 跟踪电网频率并增强锁频环FLL (frequency locked loop) 的抗干扰能力尤为重要。为此, 提出一种基于线性卡尔曼滤波的并网逆变器自适应准PR控制策略。首先, 针对传统锁频环抗干扰能力不足的问题, 设计了一种基于线性卡尔曼滤波的锁频环LKF-FLL (linear Kalman filter-frequency locked loop), 提高锁频环的抗干扰性。利用设计的LKF-FLL跟踪电网基频, 根据时变的电网基频, 实时改变准PR控制器的谐振频率以实现自适应跟踪电网基频, 从而保证准PR控制器的控制性能, 改善并网电流的电能质量。最后, 通过仿真实验及实验样机的研制, 验证LKF-FLL策略的可行性和优越性。

Abstract

Under the weak grid condition, there exists grid frequency shift, which degrades the control performance of a quasi-PR controller with constant parameters. Therefore, it is important to track the grid frequency and enhance the anti-interference capability of frequency locked loop(FLL). Under this background, an adaptive quasi-PR controller strategy based on linear Kalman filter(LKF) is proposed in this paper. First, aimed at the poor anti-interference capability of the traditional FLL, an FLL based on LKF(LKF-FLL) is designed to improve the anti-interference capability of FLL. Then, LKF-FLL is used to track grid frequency, and the resonant frequency of the quasi-PR controller is adjusted in real time to realize adaptive tracking of grid frequency according to the time-varying grid frequency, thus ensuring the control performance of the quasi-PR controller and improving the power quality of grid-connected current. Finally, through simulations and the development of an experimental prototype, the feasibility and superiority of the proposed LKF-FLL strategy was verified.

关键词

弱电网;基于线性卡尔曼滤波的锁频环;频率自适应;锁频环;抗干扰性;准PR控制器

Key words

weak grid;linear Kalman filter-frequency locked loop(LKF-FLL);adaptive frequency;FLL;anti-interference;quasi-PR controller

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