

基于模型预测的MMC-RPC直接功率控制策略

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MMC-RPC Direct Power Control Strategy Based on Model Prediction

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History

摘要

为了实现对传统铁路牵引供电系统中的负序、谐波和无功问题的综合治理,在直接功率控制基础上将模型预测与直接功率控制MPDPC(model predictive direct power control)结合引入模块化多电平结构的铁路功率调节器MMC-RPC(railway power conditioner with modular multilevel converter structure)。以每一个控制周期结束时功率误差最小为原则确定了目标函数,并在传统MPDPC控制上加入了延时补偿,以得到最优的MMC-RPC交流端口电压矢量进行调制。在Matlab/Simulink中搭建基于MPDPC的MMC-RPC仿真模型,并与直接功率控制和双闭环PI控制的MMC-RPC进行对比,验证了模型预测直接功率控制策略运用到MMC-RPC的优越性和可行性。

Abstract

To solve the problems such as negative sequence, harmonics and reactive power in the traditional railway traction power supply system, model predictive direct power control(MPDPC) is introduced to the railway power conditioner with modular multilevel converter(MMC-RPC) structure based on direct power control. The objective function is determined according to the principle of minimizing the power error at the end of each control cycle, and delay compensation is added to the traditional MPDPC to obtain the optimal voltage vector at the AC port of MMC-RPC. A simulation model of MMC-RPC based on MPDPC is built in Matlab/Simulink, and it is compared with MMC-RPC which is based on direct power control and double closed-loop PI control, thus verifying the superiority and feasibility of the application of the MPDPC strategy to MMC-RPC.

关键词

模块化多电平换流器;铁路功率调节器;模型预测控制;功率补偿;负序

Key words

modular multilevel converter(MMC);railway power conditioner(RPC);model predictive control(MPC);power compensation;negative sequence

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