

电力电子与电力传动

并联混合型有源电力滤波器稳定性及控制方法

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摘要: 分析了由并联型有源电力滤波器(parallel active power filter, PAPF)和并联电容器组成的混合补偿系统的系统稳定性。分析表明采用传统的PAPF控制方式时, 当PAPF检测的负载电流中不包含并联电容器的电流时, 混合补偿系统稳定, 并且有理想的谐波补偿效果; 当PAPF检测的负载电流中包含并联电容器的电流时, 此时混合系统存在稳定性和谐波抑制效果之间的矛盾。实际系统中检测的负载电流中包含并联电容器电流的情况有时是不可避免的, 针对这种情况提出一种同时检测负载电流和电源电压来控制PAPF输出电流的控制方案, 该控制方案可以使系统变稳定, 并且具有理想的谐波补偿效果。最后给出了仿真和实验验证结果。

关键词: 混合补偿系统 谐波抑制 电容器电流 系统稳定性 电源电压检测

Stability Analysis and Controller Design of Hybrid Parallel Active Power Filter

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Abstract: A hybrid compensation system with parallel active power filter and parallel capacitors is proposed, where parallel active power filter is used to cancel the current distortion and the capacitors are used to improve power factor. Firstly, stability of this hybrid compensation system is analyzed. With traditional control method, hybrid system is stable when the capacitor current is not included in the detected load current, but when the capacitor current is included in the detected load current, system stability and performance of harmonic elimination is incompatible in this system. Then, a control method in which both the supply voltage and load current are detected to control the output current of parallel active power filter is proposed. The proposed control method makes the hybrid system work effectively when the capacitor current is included in the detected load current and it can be easily implemented in practice. Finally, simulations and experiments results are presented to demonstrate the conclusions.

Keywords: hybrid compensation system harmonics suppression capacitor current system stability supply voltage detection

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