

电力系统

三相并网逆变器脱网运行电压控制技术

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摘要:

IEEE Std.1547-2003规定并网逆变器需要具备孤岛运行的能力以维持负载电压稳定。传统PI控制无法消除并网逆变器交流电压控制稳态误差,但关于稳态误差存在的根本原因相关文献描述较少。为了揭示其本质,首先建立了并网逆变器电压控制模型,然后通过叠加定理和频域分析得出结论:交流电压零稳态误差控制条件为:系统控制器在交流电压频率处具有无穷大增益,而PI控制不具有该特性。在上述结论基础上,采用一种可消除交流电压稳态误差的比例复数积分PCI控制,给出一套控制器参数整定方法,并采用TMS320F2812 DSP实现系统的数字化控制。在理论分析的基础上进行仿真和实验研究,通过与PI控制对比验证了PCI控制的有效性。

关键词: 三相并网逆变器 孤岛运行 电压控制

Intentional Islanding Voltage Control for Three-Phase Grid-Connected Inverters

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Abstract:

IEEE Std.1547-2003 specified that the grid connected inverters should be able to operate in intentional islanding mode for maintaining the load voltage. Conventional proportional-integral control can't achieve zero steady-state error voltage control for grid-connected inverters. Unfortunately, few literatures discuss the nature of this problem. In order to clarify the point, the linear model for the system voltage control is built, and then a conclusion is reached according to the superposition theorem and frequency-domain analysis: Zero steady-state error voltage control for grid-connected inverters is obtained on condition that the controller has the infinite gain at the excited frequency, which is not the case for PI control. Based on this conclusion, a proportional complex integral (PCI) control is presented, and a step-by-step design procedure is given. The control system is digitally implemented with TMS320F2812 DSP. Simulation and experiments are carried out based on the theoretical analysis, and the effectiveness of the proposed PCI control is verified by a comparison with PI control.

Keywords: three-phase grid-connected inverters intentional islanding voltage control

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