

电压不对称条件下电压源换流器式高压直流输电的自适应无源控制

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摘要

由于电压源换流器(voltage source converter, VSC)易受电压负序分量的影响, 需要研究系统电压不对称情况下电压源换流器式高压直流输电(VSC-HVDC)的稳定运行问题, 保证VSC-HVDC的运行性能。将三相VSC状态空间模型, 做正序、负序dq同步旋转坐标下的分解, 将包含正、负序分量的VSC模型等效成一个具有耗散性质的无源系统, 并根据VSC-HVDC的4种不同控制方式, 确定相应的正负序dq坐标下的电流参考值。在此基础上, 通过能量整形的方法设计无源控制器, 追踪参考电流, 实现独立调节瞬时有功、无功功率, 消除有功功率波动。同时为提高系统的鲁棒性, 减小参数不确定对控制效果的影响, 提出了一种自适应的无源控制方法。仿真结果表明了该控制策略具有良好的暂态控制性能。

关键词 [不对称电压](#); [无源控制](#); [自适应控制](#); [高压直流输电](#); [电压源换流器](#)

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Adaptive Passivity-Based Control for VSC-HVDC System under Unbalanced Voltage Condition

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Abstract

The voltage source converter (VSC) is quite sensitive to the negative sequence component of AC voltage, so it is necessary to research the stable operation of VSC-HVDC under unbalanced three-phase voltage to ensure the operation performance of VSC-HVDC. Decomposing the state-space model of VSC in three-phase system in the positive and negative d-q synchronous rotational coordinates and making the VSC model that contains positive and negative sequence components equivalent to a passive system with dissipative property, the reference current components in the positive and negative sequence d-q synchronous coordinates are decided according to four different control modes of VSC-HVDC. By means of energy shaping, a passivity-based controller is designed to trace the reference currents, thus the individual regulation of instantaneous active and reactive power and the elimination of active power fluctuation are realized, meanwhile, in order to improve the robustness of control system and reduce the impact of parameter uncertainty on control effect, an adaptive passivity-based control method is put forward. Simulation results show that the proposed control strategy possesses good transient control performance.

Key words [unbalanced voltage](#); [passivity-based control](#); [adaptive control](#); [HVDC](#); [voltage source converter](#)

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