电网技术 2011, 35(10) 147-152 DOI: ISSN: 1000-3673 CN: 11-2410/TM

新能源与分布式发电

含逆变型分布式电源的微网故障特征分析

韩奕,张东霞

中国电力科学研究院，北京市 海淀区 100192

摘要：

微网中的微电源大多是逆变型分布式电源，其故障特征不同于传统的同步发电机，详细分析逆变型分布式电源的故障特征，以及由此类电源组成的微网的故障特征是微网保护的基础。在DigSilent仿真软件上建立了恒功率控制和恒电压频率控制的逆变型分布式电源，以及孤岛和并网2种运行模式下微网的仿真模型，分析线路发生不同故障时电源侧及故障线路的故障特征，提出了不同控制方式下微电源的等效模型，为微网保护提供了依据。

关键词： 微网 故障特征 逆变型分布式电源 恒功率控制 恒电压频率控制

Fault Analysis of Microgrid Composed by Inverter-Based Distributed Generations

HAN YI,ZHANG Dongxia

China Electric Power Research Institute, Haidian District, Beijing 100192, China

Abstract:

Most microsources in microgrid are inverter-based distributed generations (IBDG), and their fault characteristics are different from those of traditional synchronous generators, thus detailed analysis on fault characteristics of IBDG and that of microgrid composed by IBDG are the foundation of microgrid protection. Utilizing simulation software DigSilent, the simulation model of IBDG with P-Q control and that of IBDG with V-f control as well as simulation models of microgrid under islanding operation mode and grid-connected operation mode are built to analyze fault characteristics at IBDG side and fault characteristics of faulty transmission line while different faults occur in transmission line, and equivalent models of microgrid under differnet control modes are proposed.

Keywords: microgrid fault characteristics inverter-based distributed generation (IBDG) P-Q control U-f control

收稿日期 2010-11-04 **修回日期** 2010-12-01 **网络版发布日期** 2011-10-12

DOI:

基金项目:

通讯作者: 韩奕

作者简介:

作者Email: hanyi@epri.sgcc.com.cn

参考文献：

[1] Maria B，Tim C G. Fault behaviour in islanded microgrids[C]//CIRED 19th International Conference on Electricity Distribution. Vienna，Austria：IEEE，2007：21-24. [2] Jin Qiang，Li Yongli. A study on steady characters of inverter interfaced distributed generation in three phase symmetrical system [C]//International Conference on Power System Technology. Hangzhou，China：IEEE，2010：1-7. [3] Natthaphob N，Gerald T H，Raja A，et al. Fault current contribution from synchronous machine and inverter based distributed generators [J]. IEEE Trans on Power Delivery，2007，22(1)：634-641. [4] Mesut E B，Ismail E M. Fault analysis on distribution feeders with distributed generators[J]. IEEE Trans on Power Systems，2005，20(4)：1757-1764. [5] Li Yunwei，Vilathgamuwa，D M，Poh C L. Design, analysis, and real-time testing of a controller for multibus microgrid system [J]. IEEE Trans on Power Electronics，2004，19(5)：1195-1204. [6] Kariniotakis G N，Soultanis N L，Tsouchnikas A I，et al. Dynamic modeling of microgrids[C]//International Conference on Future Power Systems. Amsterdam，Netherlands：Senter Novem，2005：1-7. [7] Nageraju P，Milan P，Timothy C G. modeling, analysis and testing of autonomous operation of an

inverter-based microgrid[J]. IEEE Trans on Power Electronics，2007，22(2)：613-625. [8] Robert H L，Paolo P. Control and design of microgrid components[R]. Comell University，New York，USA：PSERC，2006. [9] Natthaphob N，Gerald H. Consequences of fault currents contributed by distributed generation[R]. Comell University，New York，USA：PSERC，2006. [10] 王成山，肖朝霞，王守相. 微网综合控制与分析[J]. 电力系统自动化，2008，32(7)：98-103. Wang Chengshan，Xiao Zhaoxia，Wang Shouxiang. Synthetical control and analysis of microgrid[J]. Automation of Electric Power Systems，2008，32(7)：98-103(in Chinese). [11] 王成山，肖朝霞，王守相. 微网中分布式电源逆变器的多环反馈控制策略[J]. 电工技术学报，2009，24(2)：100-107. Wang Chengshan，Xiao Zhaoxia，Wang Shouxiang. Multiple feedback loop control scheme for inverters of the micro source in microgrids [J]. Transactions of China Electrotechnical Society，2009，24(2)：100-107(in Chinese). [12] Maria B，Tim C G，John D F M. Modelling and analysis of fault behaviour of inverter microgrids to aid future fault detection[C]//IEEE International Conference on System of Systems Engineering. London，UK：IEEE，2007：1-6. [13] Frank V O. Fault current source to ensure the fault level in inverter-dominated networks[C]//20th International Conference on Electricity Distribution(CIRED). Prague，Czech Republic：IET，2009：1-13. [14] Sortomme E，Mapes G J，Foster B A，et al. Fault analysis and protection of a microgrid[C]//40th North American Power Symposium. Calgary，Alberta，Canada：PES，2008：1-6. [15] Yasser A R，Ibrahim M. New control algorithms for the distributed generation interface in grid-connected and micro-grid systems [D]. Waterloo，Ontario，Canada：Waterloo University，2008. [16] Elmarkabi I M. Control and protection of distribution networks with distributed generators[D]. Raleigh，North Carolina，USA：North Carolina State University，2004. [17] Mao Yiming. Protection system design for power distribution systems in the presence of distributed generation[D]. Philadelphia，PA，USA：Drexel University，2005. [18] 丁冠军，丁明，汤广福，等. 新型多电平VSC子模块电容参数与均压策略[J]. 中国电机工程学报，2009，29(30)：1-6. Ding Guanjun，Ding Ming，Tang Guangfu，et al. Submodule capacitance parameter and voltage balancing scheme of a new multilevel VSC modular[J]. Proceeding of CSEE，2009，29(30)：1-6(in Chinese). [19] 丁冠军，汤广福，丁明，等. 新型多电平电压源换流器模块的拓扑机制与调制策略[J]. 中国电机工程学报，2009，29(36)：1-8. Ding Guanjun，Tang Guangfu，Ding Ming. et al. Topology mechanism and modulation scheme of a new multilevel voltage source converter modular[J]. Proceeding of CSEE，2009，29 (36)：1-8(in Chinese). [20] 王姗姗，周孝信，汤广福，等. 模块化多电平HVDC子模块电容值的选取[J]. 电网技术，2011，35(1)：26-32. Wang Shanshan，Zhou Xiaoxin，Tang Guangfu，et al. The selection of the sub-module DC capacitance in the MMC-HVDC system[J]. Power System Technology，2011，35 (1)：26-32(in Chinese). [21] 邓卫华，张波，丘东元，等. 三相电压型 PWM 整流器状态反馈精确线性化解耦控制研究[J]. 中国电机工程学报，2005，25(7)：97-103. Deng Weihua，Zhang Bo，Qiu Dongyuan，et al. The research of decoupled state variable feedback linearization control method of three phase voltage source PWM rectifier[J]. Proceeding of the CSEE，2005，25(7)：97-103(in Chinese).

本刊中的类似文章

1. 黄伟 孙昶辉 吴子平 张建华.含分布式发电系统的微网技术研究综述[J]. 电网技术, 2009,33(9): 14-18
2. 丁明 张颖媛 茆美琴.微网研究中的关键技术[J]. 电网技术, 2009,33(11): 6-11
3. 杨佩佩 艾欣 崔明勇 雷之力.基于粒子群优化算法的含多种供能系统的微网经济运行分析[J]. 电网技术, 2009,33(20): 38-42
4. 崔明勇 雷之力 艾欣.抑制多台分布式发电单元自治微网环流的主从控制策略[J]. 电网技术, 2011,35(4): 143-148
5. 张建华 苏玲 陈勇 苏静 王利.微网的能量管理及其控制策略[J]. 电网技术, 2011,35(7): 24-28
6. 陈益哲 张步涵 王江虹 毛彪 方仍存 毛承雄 段善旭.基于短期负荷预测的微网储能系统主动控制策略[J]. 电网技术, 2011,35(8): 35-40
7. 梁惠施 程林 刘思革.基于蒙特卡罗模拟的含微网配电网可靠性评估[J]. 电网技术, 2011,35(10): 76-81