

## 电力系统

### 基于小世界网络的连锁故障实时搜索系统

郑阳<sup>1</sup>, 刘文颖<sup>1</sup>, 温志伟<sup>2</sup>, 平德明<sup>2</sup>

1. 华北电力大学 电气与电子工程学院, 北京市 昌平区102206; 2. 甘肃电力科学研究院, 甘肃省 兰州市 730000

#### 摘要:

本文基于小世界特性分析了电网连锁故障的传播机理, 指出长程连接的出现增加了故障传播的广度和深度, 从而对连锁故障的传播起到推动作用。以此为基础, 建立了连锁故障实时搜索系统, 采用优先级模块, 可从WAMS采集到的海量实时数据中, 快速有效的搜索到故障源头, 并通过实例验证了该方法的正确性和有效性。

#### 关键词:

### A Real-Time Searching System for Cascading Failures Based on Small-World Network

ZHENG Yang<sup>1</sup>, LIU Wen-ying<sup>1</sup>, WEN Zhi-wei<sup>2</sup>, PING De-ming<sup>2</sup>

1. School of Electrical and Electronic Engineering, North China Electric Power University, Changping District, Beijing 102206, China; 2. Electric Power Research Institute of Gansu Province, Lanzhou 730000, Gansu Province, China

#### Abstract:

Based on small-world characteristics, the spreading inherent mechanism of cascading failures in power grid was studied in this paper. The results of the experiments show that the appearance of long-range connectivity has increased the breadth and depth of spreading, so that it pushes the cascading failure to spread forward. A real-time searching system for cascading failures using the priority module is set up to find the source of the failures quickly and efficiently from massive real-time data of WAMS. The correctness and effectiveness of the proposed method are validated by an example.

#### Keywords:

收稿日期 2009-08-30 修回日期 2009-11-18 网络版发布日期 2010-07-13

#### DOI:

#### 基金项目:

甘肃省自然科学基金资助项目(0803RJZA028)。

通讯作者: 郑阳

#### 作者简介:

作者Email: wangziheng8079@sina.com

#### 参考文献:

- [1] US-Canada Power System Outage Task Force. Final report on the August 14, 2003 blackout in the United States and Canada: causes and recommendations [R/OL]. [2009-06-12]. [Http://www.nerc.com](http://www.nerc.com).
- [2] Carreras B A, Lynch V E, Dobson I, et al. Blackout mitigation in an electric power transmission system[C]. The 36th Hawaii International Conference on System Sciences, Hawaii, USA, 2003.
- [3] Dobson I, Chen J, Carreras B A, et al. Examining criticality of blackouts in power system models with cascading events[C]. The 35th Hawaii International Conference on System Sciences, Hawaii, USA, 2002.
- [4] Dobson I, Carreras B A, Lynch V E, et al. An initial model for complex dynamics in electric power system blackouts[C]. The 34th Hawaii International Conference on System Sciences, Hawaii, USA, 2001.
- [5] Chen J, Thorp J S, Dobson I. Cascading dynamics and mitigation assessment in power system disturbances via a hidden failure model [J]. Electrical Power and Energy Systems, 2005, 27(4): 318-326.
- [6] Carreras B A, Newman D E, Dobson I, et al. Evidence for self-organized criticality in electric power system blackouts[C]. The 34th Hawaii International Conference on System Sciences, Hawaii, USA, 2001.

#### 扩展功能

##### 本文信息

- ▶ Supporting info
- ▶ PDF(245KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

##### 服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

本文作者相关文章

PubMed

[7] Watts D J. Small worlds: The dynamics of networks between order and randomness[M]. Princeton, NJ, USA: Princeton University Press, 1998: 27-35. [8] Surdutovich G, Cortez C, Vitilina R, et al. Dynamics of "small world" networks and vulnerability of the electric power grid[C]. VIII Symposium of Specialists in Electric Operational and Expansion Planning, Brasilia, Brasil, 2002. [9] 孟仲伟, 鲁宗相, 宋靖雁. 中美电网的小世界拓扑模型比较分析[J]. 电力系统自动化, 2004, 28(15): 21-24. Meng Zhongwei, Lu Zongxiang, Song Jingyan. Comparison analysis of the small-world topological model of Chinese and American power grids[J]. Automation of Electric Power Systems, 2004, 28(15): 21-24(in Chinese). [10] 李蓉蓉, 张晔, 江全元. 复杂电力系统连锁故障的风险评估[J]. 电网技术, 2006, 30(10): 18-23. Li Rongrong, Zhang Ye, Jiang Quanyuan. Risk assessment for cascading failures of complex power system[J]. Power System Technology, 2006, 30(10): 18-23(in Chinese). [11] 邓慧琼, 艾欣, 余洋洋, 等. 电网连锁故障的概率分析模型及风险评估[J]. 电网技术, 2008, 32(15): 41-46. Deng Huiqiong, Ai Xin, Yu Yangyang, et al. Probability analysis model and risk assessment of power system cascading failure[J]. Power System Technology, 2008, 32(15): 41-46(in Chinese). [12] 曾宪钊. 网络科学[M]. 北京: 军事科学出版社, 2006: 95-99. [13] 汪小帆, 李翔, 陈关荣. 复杂网络理论及其应用[M]. 北京: 清华大学出版社, 2006: 22-24. [14] 李生虎, 丁明, 王敏, 等. 考虑故障不确定性和保护动作性能的电网连锁故障模式搜索[J]. 电网技术, 2004, 28(13): 27-31. Li Shenghu, Ding Ming, Wang Min, et al. Search of power system chained failure mode considering uncertainty of element fault and performance of protective relaying[J]. Power System Technology, 2004, 28(13): 27-31(in Chinese). [15] Albert R, Barabasia L. Statistical mechanics of complex networks[J]. Reviews of Modern Physics, 2002, 74 (1): 47-97. [16] Albert R, Albert I, Nakarado G L. Structural vulnerability of the North American power grid[J]. Physical Review E, 2004, 69(2): 1-4. [17] Bhargava B. Synchronized phasor measurement system project at Southern California Edison Co[C]. IEEE Power Engineering Society Summer Meeting, Edmonton, Alberta, Canada, 1999. [18] 许树楷, 谢小荣, 辛耀中. 基于同步相量测量技术的广域测量系统应用现状及发展前景[J]. 电网技术, 2005, 29(2): 44-49. Xu Shukai, Xie Xiaorong, Xin Yaozhong. Present application situation and development tendency of synchronous phasor measurement technology based wide area measurement system[J]. Power System Technology, 2005, 29(2): 44-49(in Chinese). [19] 邓慧琼, 艾欣, 张东英, 等. 基于不确定多属性决策理论的电网连锁故障模式搜索方法[J]. 电网技术, 2005, 29(13): 50-55. Deng Huiqiong, Ai Xin, Zhang Dongying, et al. Search technique for power system cascading outages based on uncertain multiple attribute decision-making[J]. Power System Technology, 2005, 29(13): 50-55(in Chinese).

#### 本刊中的类似文章