

新能源与分布式发电

基于马尔可夫链的光伏发电系统输出功率短期预测方法

丁明, 徐宁舟

教育部光伏系统工程研究中心(合肥工业大学), 安徽省 合肥市 230009

摘要:

提出了一种直接预测光伏电站出力的方法。该方法基于马尔科夫链, 通过统计光伏电站历史功率数据建模, 直接预测光伏电站出力。理论推导证明了该数学模型的可行性。以教育部光伏中心的光伏电站为例进行建模预测, 证明了该方法的有效性, 并通过调整模型参数获得了更加精确的结果。

关键词:

A Method to Forecast Short-Term Output Power of Photovoltaic Generation System Based on Markov Chain

DING Ming, XU Ningzhou

Research Center for Photovoltaic System Engineering (Hefei University of Technology), Ministry of Education, Hefei 230009, Anhui Province, China

Abstract:

A method to forecast output power of photovoltaic (PV) plant is proposed. Based on Markov chain utilizing the statistics of historical data of PV plant, a model of PV plant is built and the output power of the PV plant can be directly forecasted. The feasibility of the proposed mathematical model is verified by theoretical derivation. Taking the PV plant in PV Centre of the Ministry of Education (MOE) of the People's Republic of China for example, the modeling of the PV plant is performed and the output power forecasting proves the effectiveness of the proposed method. More accurate forecasting results are obtained by adjusting the parameters of the built model.

Keywords:

收稿日期 2010-05-31 修回日期 2010-06-13 网络版发布日期 2011-01-18

DOI:

基金项目:

国家自然科学基金项目(50837001); 国家863高技术基金项目(2007AA05Z240); 国家重点基础研究发展计划项目(973项目)(2009CB219702)。

通讯作者: 丁明

作者简介:

作者Email: mingding56@126.com, mingding@mail.hf.ah.cn

参考文献:

- [1] 许洪华. 中国光伏发电技术发展研究[J]. 电网技术, 2007, 31(20): 7-11. Xu Honghua. The study on development of PV technology in China [J]. Power System Technology, 2007, 31(20): 7-11(in Chinese).
- [2] Safie F M. Probabilistic modeling of solar power systems[C]// Reliability and Maintainability Symposium. Atlanta, Georgia, USA: IEEE, 1989: 425-430.
- [3] Tina G, Gagliano S, Raiti S. Hybrid solar wind power system probabilistic modeling for long-term performance assessment[J]. Solar Energy, 2006, 80(5): 578-588.
- [4] Chowdhury B H. Central-station photovoltaic plant with energy storage for utility peak load leveling[C]//Energy Conversion Engineering Conference. Washington DC, USA: Institute of Electrical and Electronics Engineers, 1989: 731-736.
- [5] Deshmukh M K, Deshmukh S S. Modeling of hybrid renewable energy systems[J]. Renewable and Sustainable Energy Reviews, 2008, 12(1): 235-249.
- [6] Kroposki B, Emery K, Myers D, et al. A comparison of photovoltaic module performance evaluation methodologies for energy ratings[J]// Proceedings of 1th WCPEC. Hawaii, USA, 1994: 5-9.
- [7] Li Yingzi, Niu Jincang, Ru Luan, et al. Research of multi-power structure optimization for grid-connected photovoltaic system based on

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(259KB)
- ▶ [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

Markov decision-making model[C]//International Conference on Electrical Machines and Systems. Wuhan, China, 2008: 2607-2610. [8] Li Yingzi, Luan Ru, Niu Jincang. Forecast of power generation for grid-connected photovoltaic system based on grey model and Markov chain[C]//3rd IEEE Conference on Industrial Electronics and Applications. Singapore, 2008: 1729-1733. [9] Perez R, Ineichen P, Seals R, et al. Modeling daylight availability and irradiance components from direct and global irradiance[J]. Solar Energy, 1990, 44(5): 271-289. [10] National Renewable Energy Laboratory. National solar radiation database user's manual(1961—1990)[R]. Version 1.1. Washington DC, USA: National Renewable Energy Laboratory, 1994. [11] National Renewable Energy Laboratory's Analytic Studies Division. Solar radiation data manual for flat-plate and concentrating collectors [R]. Washington DC, USA: National Renewable Energy Laboratory, 1994. [12] Angel U, Rudolph J, David I, et al. Probabilistic analysis of rechargeable batteries in a photovoltaic power supply system[R]. Livermore, California: Sandia National Laboratories, 1998. [13] Silverman B. Density estimation for statistics and data analysis[C]// Monographs on Statistics and Applied Probability 26. London, UK, 1986: 22-23. [14] Angel U, Thomas L P, Christian O G, et al. Reliability of rechargeable batteries in a photovoltaic power supply system[J]. Journal of Power Sources, 1999, 80(1-2): 30-38. [15] Isaacson D, Madsen R. Markov chains: theory and applications[M]. New York: Wiley, 1976: 23-68. [16] 石文辉, 别朝红, 王锡凡. 大型电力系统可靠性评估中的马尔可夫链蒙特卡洛方法[J]. 中国电机工程学报, 2008, 28(4): 9-15. Shi Wenhui, Bie Zhaohong, Wang Xifan. Applications of Markov Chain Monte Carlo in large-scale system reliability evaluation[J]. Proceedings of the CSEE, 2008, 28(4): 9-15(in Chinese). [17] 高亚静, 周明, 李庚银, 等. 基于马尔可夫链和故障枚举法的可用输电能力计算[J]. 中国电机工程学报, 2006, 26(19): 41-46. Gao Yajing, Zhou Ming, Li Gengyin, et al. Available transfer capability calculation based on Markov chain and enumeration method[J]. Proceedings of the CSEE, 2006, 26(19): 41-46(in Chinese).

本刊中的类似文章