电网技术 2010, 34(9) 82-87 DOI: ISSN: 1000-3673 CN: 11-2410/TM

电力系统

基于田口法与李雅普诺夫函数的鲁棒PSS参数设计

陈刚1，唐毅1，张继红2

1．输配电装备及系统安全与新技术国家重点实验室(重庆大学)，重庆市 沙坪坝区 400044；2．重庆电网电力交易中心，重庆市 渝中区400014

摘要：

电力系统稳定器(power system stabilizer, PSS)是抑制低频振荡的有效手段，其参数设计直接影响到PSS性能的优劣。为使设计的PSS参数具有良好的鲁棒性，克服传统特征值分析方法设计PSS参数的缺点，基于田口法的设计原理，以特定的李雅普诺夫函数计算出的信噪比最大化为目标函数，采用遗传算法对PSS参数进行优化设计。单机无穷大算例的仿真结果表明，通过该方法进行PSS参数优化设计，能更好地提取系统中的有用信息，大大减少了计算量，所设计的PSS具有良好的抑制振荡能力和鲁棒性，其综合性能优于传统方法。

关键词：

Robust Parameter Design of Power System Stabilizer Based on Taguchi Method and Lyapunov Function

CHEN Gang1, TANG Yi1, ZHANG Jihong2

1. State Key Laboratory of Power Transmission Equipment & System Security and New Technology (Chongqing University),Shapingba District, Chongqing 400044, China; 2. Chongqing Electric Power Trading Center,Yuzhong District, Chongqing 400014, China

Abstract:

Power system stabilizer (PSS) is an effective device to suppress low-frequency oscillation in power system, so its parameter design directly influences the performance of PSS. To make the designed PSS parameters possessing good robustness to remedy the insufficiency of PSS parameters designed by traditional eigenvalue analysis method, utilizing basic design principle of Taguchi method and the maximized signal to noise ratio (SNR) calculation by specific Lyapunov function is taken as objective function and the optimal design of PSS parameters are optimized by genetic algorithm (GA). Simulation results of single-machine infinite bus system show that applying the proposed optimal design method to the design of PSS parameters the useful system information can be extracted more effectively and the calculation burden can be obviously reduced. The designed PSS possesses good oscillation suppression ability and robustness, and its comprehensive performance is superior to that of PSSs designed by traditional design methods.

Keywords:

收稿日期 2010-01-22 **修回日期** 2010-07-29 **网络版发布日期** 2010-09-08

DOI:

基金项目:

国家自然科学基金项目(50807055)。

通讯作者: 唐毅

作者简介:

作者Email: soledssa@163.com

参考文献：

[1] 王庆红，Overbye T J．电力系统低频振荡模态和参与因子的可视化方法[J]．电网技术，2008，32(10)：74-78． Wang Qinghong，Overbye T J．Visualization method of power system low-frequency oscillation mode shape and participation factor [J]．Power System Technology，2008，32(10)：74-78 (in Chinese)． [2] 郭培源，冯世洪，郭思贞．采用综合阻尼系数研究附加励磁控制系统参数的动态特性[J]．电网技术，1999，23(2)：6-9． Guo Peiyuan，Feng Shihong，Guo Sizhen．Reserch on supplementary excitation control parameter characteristics adapting comprehensive damping coefficient[J]．Power

System Technology，1999，23(2)：6-9(in Chinese)． [3] 张军政．华润电厂300 MW发电机组的电力系统稳定器参数整定试验[J]．电网技术，2005，29(11)：73-76． Zhang Junzheng．Parameter setting test of power system stabilizer for 300 MW generator in Huarun Power Plant[J]．Power System Technology，2005，29(11)：73-76(in Chinese)． [4] 赵书强，常鲜戎，贺仁睦，等．PSS控制过程中的借阻尼现象与负阻尼效应[J]．中国电机工程学报，2004，24(5)：7-11． Zhao Shuqiang，Chang Xianrong，He Renmu，et al． Borrow damping phenomena and negative damping effect of PSS control [J]．Proceedings of the CSEE，2004，24(5)：7-11(in Chinese)． [5] 刘取．电力系统稳定性及发电机励磁控制[M]．北京：中国电力出版社，2007． [6] 赵辉，刘鲁源，张更新．基于微粒群优化算法的最优电力系统稳定器设计[J]．电网技术，2006，30(3)：32-35． Zhao Hui，Liu Luyuan，Zhang Gengxin．Optimal design of power system stabilizer using particle swarm optimization[J]．Power System Technology，2006，30(3)：32-35(in Chinese)． [7] 牛振勇，杜正春，方万良，等．基于进化策略的多机系统PSS参数优化[J]．中国电机工程学报，2004，24(2)：22-27． Niu Zhenyong，Du Zhengchun，Fang Wanliang，et al．Parameter optimization of multi-machine power system stabilizers using evolutionary strategy[J]．Proceedings of the CSEE，2004，24(2)：22-27(in Chinese)． [8] 胡晓波，杨利民，陈中，等．基于人工鱼群算法的PSS参数优化[J]．电力自动化设备，2009，29(2)：47-50． Hu Xiaobo，Yang Limin，Chen Zhong，et al．PSS patameter optimization based on artificial fish-swarm algorithm[J]．Electric Power Automation Equipment，2009，29(2)：47-50(in Chinese)． [9] Abdel-Magid Y L，Abido M A，Al-Baiyat S，et al．Simultaneous stabilization of multi-machine power systems via genetic algorithms [J]．IEEE Trans on Power Systems，1999，14(4)：1428-1439． [10] Zhao Qiaoe，Su Xiaolin，Zhou Shuangxi．Research of power system stabilizer based on prony on-line identification and neural network control[C]．International Conference on IEEE Electrical Machines and Systems，ICEMS，2008． [11] Abdel-Magid Y L，Abido M A．Optimal multiobjective design of robust power system stabilizers using genetic algorithms[J]．IEEE Trans on Power Systems，2003，18(3)：1125-1132． [12] Karnik S R，Raju A B，Raviprakasha M S．Genetic algorithm based robust power system stabilizer design using taguchi principle [C]．First International Conference on IEEE Emerging Trends in Engineering and Technology，ICETET'08，2008． [13] Taguchi G，Chowdhury S，Taguchi S．Robust engineering[M]．New York：McGraw-Hill，2000． [14] Wu Y，Taguchi．Methods for robust design[M]．New York：ASME，2000． [15] 金天雄，金石男，江平开，等．有限元法与田口方法相结合模拟研究交联聚乙烯电缆绝缘中的水树现象[J]．绝缘材料，2008，41(3)：45-48． Kim Chonung，Kim Seuknam，Jiang Pingkai，et al．Research on simulation of water treeing in XLPE cable insulation using combination of FEM and Taguchi method [J]．Insulation Materials，2008，41(3)：45-48(in Chinese)． [16] Bounou M，Lefebvre S X．Dai Do．Improving the quality of an optimal power flow solution by Taguchi method[J]．Elect．Power Energy Syst，1995，17(2)：113-118． [17] 卢强，王仲鸿，韩英铎．输电系统最优控制[M]．北京：科学出版社，1984． [18] 刘豹．现代控制理论[M]．2版．北京：机械工业出版社，2000． [19] 雷英杰．MATLAB遗传算法工具箱及应用[M]．西安：西安电子科技大学出版社，2005． [20] Milano F．An open source power system analysis toolbox[J]．IEEE Trans on Power Systems，2005，20(3)：1199-1206．

本刊中的类似文章
