

研究论文

求解多峰全局优化问题的智能辅助函数法

范磊¹;王宇平²;刘西洋¹

- (1. 西安电子科技大学 软件工程研究所, 陕西 西安 710071;
2. 西安电子科技大学 计算机学院, 陕西 西安 710071)

摘要:

辅助函数法在求解多峰全局优化问题时通常存在参数敏感和难以求解高维问题的缺陷, 针对这两类缺陷提出了一种智能辅助函数法. 首先, 利用平滑函数来消除比当前找到的最好解差的解, 在此基础上设计了一种新的辅助函数, 该辅助函数仅包含一个易于设置的参数, 而且可以有效地避免由于参数设置不当导致的“Mexican hat”效应; 然后, 分析了提出的辅助函数的性质, 将辅助函数与智能优化技术相结合来提高算法的搜索能力, 从而保证了算法在求解高维问题时能够成功找到全局最优解; 最后, 在数值实验中, 利用13个标准测试函数来测试算法中参数的影响以及算法的搜索性能.

关键词: 多峰优化 全局优化 极小化 智能辅助函数法

Intelligent auxiliary function method for multimodal global optimization problems

FAN Lei¹;WANG Yuping²;LIU Xiyang¹

- (1. Research Inst. of Software Engineering, Xidian Univ., Xi'an 710071, China;
2. School of Computer Science and Technology, Xidian Univ., Xi'an 710071, China)

Abstract:

When solving multimodal global optimization problems, many auxiliary function methods are sensitive to their parameters and of great difficulty in dealing with high dimensional problems. Aiming to overcome these two disadvantages, a new intelligent auxiliary function method is proposed in this paper. Firstly, the smoothing function is employed to eliminate the solutions worse than the best one found so far. Based on the smoothing function, a novel auxiliary function is constructed, in which there is only one easily-adjusted parameter. This auxiliary function can avoid the unwilling “Mexican hat” effect caused by improper parameter settings. Then, properties of the auxiliary function are analyzed. In order to improve the searching ability, the proposed auxiliary function and intelligent optimization techniques are assembled in the designed method, which can help the method deal with high dimensional problems. Finally, 13 different benchmarks are used to test the influence of the parameter and the performance of the searching method. Experimental results indicate the effectiveness of the proposed method.

Keywords: multimodal optimization global optimization minimization intelligent auxiliary function method

收稿日期 2012-05-21 修回日期 网络版发布日期

DOI: 10.3969/j.issn.1001-2400.2013.05.024

基金项目:

国家自然科学基金资助项目(61272119, 61203372); 中央高校基本科研业务费专项资金资助项目(K5051303009)

通讯作者: 范磊

作者简介: 范磊(1983-), 男, 讲师, E-mail: lfan@mail.xidian.edu.cn.

作者Email: lfan@mail.xidian.edu.cn

参考文献:

- [1] Floudas C A, Gounaris C E. A Review of Recent Advances in Global Optimization [J]. Journal of Global Optimization, 2009, 45(1): 3-38.
 - [2] 姜建国, 龙秀萍, 田旻, 等. 一种基于佳点集类电磁机制算法 [J]. 西安电子科技大学学报, 2011, 38(6): 167-172.
- Jiang Jianguo, Long Xiuping, Tian Min, et al. Electromagnetism-like Mechanism Algorithm Based on the

扩展功能

本文信息

- Supporting info
- PDF(1662KB)
- [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

- 多峰优化
- 全局优化
- 极小化
- 智能辅助函数法

本文作者相关文章

- 范磊

PubMed

- Article by Fan, l

Good Point Set [J]. Journal of Xidian University, 2011, 38(6): 167-172.

[3] 刘星宝, 蔡自兴, 王勇, 等. 用于全局优化问题的混合免疫进化算法 [J]. 西安电子科技大学学报, 2010, 37(5): 971-980.

Liu Xingbao, Cai Zixing, Wang Yong, et al. Hybrid Immune Evolutionary Algorithm for Global Optimization Problems [J]. Journal of Xidian University, 2010, 37(5): 971-980.

[4] Fan Lei, Wang Yuping. A Minimum-Elimination-Escape Memetic Algorithm for Global Optimization: MEEM [J]. International Journal of Innovative Computing, Information and Control, 2012, 8(5): 3689-3704.

[5] Ge Renpu. A Filled Function Method for Finding a Global Minimizer of a Function of Several Variables [J]. Mathematical Programming, 1990, 46(1-3): 191-204.

[6] Parsopoulos K E, Vratatis M N. On the Computation of all Global Minimizers Through Particle Swarm Optimization [J]. IEEE Transactions on Evolutionary Computation, 2004, 8(3): 211-224.

[7] Wang Yuncheng, Fang Weiwu, et al. A Cut-peak Function Method for Global Optimization [J]. Journal of Computational and Applied Mathematics, 2009(230): 135-142.

[8] Wang Yuping, Fan Lei. A Smoothing Evolutionary Algorithm with Circle Search for Global Optimization [C] //Proceedings of 4th International Conference on Network and System Security.

Piscataway: IEEE Computer Society, 2010: 412-418.

[9] Wang Yongjun, Zhang Jianshe. A New Constructing Auxiliary Function Method for Global Optimization [J]. Mathematical and Computer Modelling, 2008(47): 1396-1410.

[10] Zhu Wenxing, Fu Qingxiang. A Sequential Convexification Method (SCM) for Continuous Global Optimization [J]. Journal of Global Optimization, 2003(26): 167-182.

[11] Levy A V, Montalvo A. The Tunneling Algorithm for the Global Minimization of Functions [J]. SIAM Journal of Scientific and Statistical Computing, 1985, 6(1): 15-29.

[12] Cetin B C, Barhne J, Burdick J W. Terminal Repeller Unconstrained Subenergy Tunneling (TRUST) for Fast Global Optimization [J]. Journal of Optimization Theory and Applications, 1993, 77(1): 97-126.

[13] Kostuwichi J, Pidla L. Diffusion Equation Method of Global Minimization: Performance for Standard Test Functions [J]. Journal of Optimization Theory and Applications, 1991, 69(2): 97-126.

[14] Rinnooy K A H G, Timmer G T. Stochastic Global Optimization Methods, Part II: Multi-level Methods [J]. Mathematical Programming, 1987(39): 57-78.

本刊中的类似文章

1. 赵俊;陈建军.混沌粒子群优化的模糊神经PID控制器设计

[J]. 西安电子科技大学学报, 2008,35(1): 54-59

2. 王芳林;徐国华;陈建军.机加零件可制造性研究中的工艺参数优化方法[J]. 西安电子科技大学学报, 2000,27(4): 404-408

3. 暂时无作者信息.梯度神经网络的全局H-稳定性与吸引域[J]. 西安电子科技大学学报, 2001,28(4): 546-549

4. 李清华;邵志标;耿莉.高频单片DC/DC转换器中双层平面电感的优化

[J]. 西安电子科技大学学报, 2007,34(2): 322-326

5. 姜建国;刘永青;尚海豹;林龙军;王双记.一种改进的类电磁机制算法[J]. 西安电子科技大学学报, 2013,40(3): 87-94

6. 李团结;曹玉岩;孙国鼎.动态改变邻域空间和搜索步的自由搜索算法[J]. 西安电子科技大学学报, 2010,37(4): 737-742

7. 刘星宝;蔡自兴;王勇;彭伟雄.用于全局优化问题的混合免疫进化算法[J]. 西安电子科技大学学报, 2010,37(5): 971-980

8. 马苗;梁建慧;郭敏.基于细菌觅食算法的SAR图像阈值分割[J]. 西安电子科技大学学报, 2011,38(6): 152-158+178

9. 姜建国;龙秀萍;田旻;李锦.一种基于佳点集的类电磁机制算法[J]. 西安电子科技大学学报, 2011,38(6): 167-172