应用数学学报
Acta Mathematicae Applicatae Sinica (Chinese Series)
ISSN 0254-3079
CN 11-2040/O1

应用数学学报 » 2011, Vol. 34 » Issue (4): 655-670 DOI:

不等式约束优化的非单调可行信赖域-SQP算法

孙中波[1], 段复建[2]
1. 东北师范大学人文学院数学系, 长春 130117;
2. 桂林电子科技大学数学与计算科学学院, 桂林 541004

A Feasible Trust Region SQP Method with Nonmonotone Line Search for Inequality Constrained Optimization

SUN Zhongbo[1], DUAN Fujian[2]
1. Department of Mathematical Education, College of Humanities and Sciences of Northeast Normal University, Changchun 130117;
2. School of Computational Science and Mathematics, Guilin University of Electronic Technology, Guilin 541004

摘要 本文讨论不等式约束优化问题, 给出一个信赖域方法与SQP方法相结合的新的可行算法, 算法中采用了``压缩技术'', 使得QP子问题产生的搜索方向尽可能为可行方向, 并且采用了高阶校正的方法来克服算法产生的Maratos效应现象. 在适当的条件下, 证明了算法的全局收敛性和超线性收敛性. 数值结果表明算法是有效的.

关键词: 非单调线搜索 信赖域算法 SQP算法 全局收敛性 超线性收敛性

Abstract: In this paper, inequality constrained programming problems are discussed, based on a combination technique of a trust region method and an SQP method, a new feasible algorithm is proposed. A “compression” technique is used such that search direction is feasible for QP subproblem. We use high order revised direction to avoid Marotos effect. Under some suitable conditions, the global and superlinear convergence can be induced.

Key words: nonmonotone line search trust region method SQP method global convergence superlinear convergence

收稿日期: 2010-04-24;

基金资助:

国家自然科学基金(10861005), 广西自然科学基金(0728206, 0991238)资助项目.

引用本文:
. 不等式约束优化的非单调可行信赖域-SQP算法[J]. 应用数学学报, 2011, 34(4): 655-670.

. A Feasible Trust Region SQP Method with Nonmonotone Line Search for Inequality Constrained Optimization[J]. Acta Mathematicae Applicatae Sinica, 2011, 34(4): 655-670.

[1] Powell M J D. On the Global Convergence of Trust Region Algorithm for Unconstrained Minimization. Mathematical Programming, 1984, 29: 297-303

[2] Shultz G A, Schbaoel R B, Byrd R H. A Family of Trust-region-based Algorithms for Unconstrained Minimization with Strong Global Convergence Properties. SIAM Journal on Numerical Analysis, 1985, 22: 47-67

[3] Yuan Y. On a Subproblem of Trust Region Algorithms for Constrained Optimization. Mathematical Programming, 1990, 47: 53-63

[4] Sun W Y. On Nonquadratic Model for Unconstrained Optimization. Asia and Pacific Journal of Operational Research, 1996, 13: 43-63

[5] Grippo L, Lampariello F, Lucidi S. A Truncated Newton Method with Nonmonotone Line Search for Unconstrained Optimization. Journal

of Optimization Theory and Application, 1989, 60: 401-419

[6] Yang Y, Sun W Y. A New Nonmonotonic Self-adaptive Trust Region Algorithm with Line Search. Chinese Journal of Engineering Mathematics, 2007, 24: 788-794

[7] Fu J H, Sun W Y. Nonmonotone Adaptive Trust-region Method for Unconstrained Optimization Problems. Applied and Mathematical Computation, 2005, 163: 489-504

[8] Han S P. A Globally Convergent Method for Nonlinear Programming. Journal of Optimization Theory and Applications, 1977, 22: 297-309

[9] Panier E R, Tits A L, Zhou J. Avoiding the Marotos Effect by Means of a Nonmonotone Line Search I: General Constrained Problems. SIAM Journal on Numerical Analysis, 1991, 28: 1183-1195

[10] Bonnans J F, Panier E R, Tits A L, Zhou J. Avoiding the Marotos Effect by Means of a Nonmonotone Line Search II: Inequality Constrained Problems-feasible Iterates. SIAM Journal on Numerical Analysis, 1992, 29: 1187-1202

[11] Panier E R, Tits A L, Hersovits J N. A QP-free, Globally Convergent, Locally Superlinearly Convergent Algorithm for Inequality Constrained Optimization. SIAM Journal on Control and Optimization, 1988, 26: 788-811

[12] Zhang J L, Zhang X S. A Modified SQP Method with Nonmonotone Linesearch Technique. Jounal of Global Optimization, 2001, 21: 201-218

[13] 简金宝. 非线性不等式约束最优化快速收敛的可行信赖域算法. 计算数学, 2002, 24(3): 273-282 (Jian J B. A Feasible Trust Region Algorithm with Fast Convergence for Nonlinear Inequality Constrained Opitmization. Journal of Mathematica Numerica Sinica, 2002, 24: 273-282)

[14] Zhu Z B, Zhang K C, Jian J B. A Improved SQP Algorithm for Inequality Constrained Optimization. Jounal of Mathematical Method of Operations Research, 2003, 58: 271-282

[15] Zhu Z B. A Interior Point Type QP-gree Algorithm with Superlinear Convergence for Inequality Constrained Optimization. Jounal of Applied Mathematical Modelling, 2007, 31: 1201-1212

[16] Zhu Z B. A Sequential Constrained Quadratic Programming Algorithm for Inequality Constrained Optimization. Jounal of Computational and Applied Mathematics, 2008, 212: 112-125

[17] Yuan Y, Sun W Y. Optimization Theory and Methods Nonlinear Programming, Vol.1. New York: Springer-Verlag, 2006

[1] 闫晖, 陈兰平. 一个新的具有充分下降性的混合共轭梯度算法[J]. 应用数学学报, 2011, 34(4): 634-643.

[2] 王祥, 陈金梅. 一类约束优化问题的非单调信赖域算法[J]. 应用数学学报, 2010, 33(4): 663-670.

[3] 刘金魁, 杜祥林, 王开荣. 两类新的变参数下降算法及收敛性[J]. 应用数学学报, 2010, 33(2): 222-232.

[4] 谭 玲, 段复建, 范 林. 非线性互补约束问题一个全局收敛的 SQP算法[J]. 应用数学学报, 2009, 32(1): 37-49.

[5] 刘洪伟. 基于非单调自适应信赖域法求解非线性方程组[J]. 应用数学学报, 2008, 31(6): 1128-1136.

[6] 朱志斌, 张可村. 一个新的共轭投影梯度算法及其超线性收敛性[J]. 应用数学学报, 2004, 27(1): 149-161.

[7] Ju Liang ZHANF, Xiang Sun ZHANG, Zhong Wen CHEN. 一个无正则条件下一般约束最优化问题的信赖域算法的收敛性[J]. 应用数学学报, 2003, 26(1): 1-10.

[8] 张菊亮, 章祥荪. 一个等式约束问题的SQP方法及其收敛性[J]. 应用数学学报, 2001, 24(1): 1-009.

[9] 张建军, 王德人. 关于广义Newton法的收敛性问题[J]. 应用数学学报, 1999, 22(4): 513-521.

[10] 李正锋, 邓乃扬. 一类新的非单调信赖域算法及其收敛性[J]. 应用数学学报, 1999, 22(3): 457-405.

[11] Guo Sha LIU, An Xin WANG, Long Zhen LI. 一种改进的无约束非光滑优化问题的信赖域算法[J]. 应用数学学报, 1999, 22(3): 337-342.