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A GENERALIZED SUBGRADIENT METHOD WITH PIECEWISE LINEAR SUBPROBLEM

Adil M. Bagirov[1,3], A. Nazari Ganjehlou[1], Hakan Tor[2] and Julien Ugon[1]

[1]Center for Informatics and Applied Optimisation, Graduate School of ITMS
Ballarat University, P.O. Box 663, Ballarat, Vic. Australia
email:{a.bagirov,a.nazari,j.ugon}@ballarat.edu.au
[2] Department of Mathematics, Middle East Technical University Ankara and
Department of Mathematics Yüzüncü Yil, Van, Turkey
email: h.tor@metu.edu.tr
[3] corresponding author.

Abstract. In this paper, a new version of the quasisecant method for nonsmooth nonconvex optimization is developed. Quasisecants are overestimates to the objective function in some neighborhood of a given point. Subgradients are used to obtain quasisecants. We describe classes of nonsmooth functions where quasisecants can be computed explicitly. We show that a descent direction with sufficient decrease must satisfy a set of linear inequalities. In the proposed algorithm this set of linear inequalities is solved by applying the subgradient algorithm to minimize a piecewise linear function. We compare results of numerical experiments between the proposed algorithm and subgradient method.

Keywords. Nonsmooth optimization, nonconvex optimization, subgradient methods, subdifferential, bundle method.

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1 Introduction

Consider the following unconstrained minimization problem:

$$\text{minimize} \quad f(x) \quad \text{subject to} \quad x \in \mathbb{R}^n \tag{1}$$

where the objective function f is locally Lipschitz. Over the last four decades subgradient [22], bundle [12, 14, 16, 17, 19, 20, 23], and the discrete gradient methods [1, 2, 3, 4, 5] have been proposed for solving this problem.

Among these methods the subgradient method is the simplest one, although its convergence is proved only under convexity assumption on the function f (see, [9, 21, 22] for details). Better convergence results were obtained when the minimum value f^* of the objective function f is known. In this paper, our aim is to develop a minimization algorithm based on the subgradient methods which is still simple, easy to implement and applicable to a wider class of minimization problems than the subgradient algorithms. We show that descent directions are the solutions of a system of linear inequalities. In the proposed algorithm, the solution of this system is reduced to the