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Combining trust-region and line-search algorithms for minimization subject to bounds[1)]

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Abstract. In this paper, we combine the trust-region technique with line searches to develop an iterative method for solving minimization problems subject to bounds. The new method is an extension of the algorithm proposed by Coleman and Li [3]. At each iteration, the solution of the subproblem provides a descent direction of the objective function. If the trial step cannot be accepted by trust-region method, we can use backtracking to find the next iterative point. Compared to the traditional trust-region methods, the new algorithm need not solve the subproblem repeatedly and so it is more economical. Under general conditions, the global convergence of the new algorithm can be proved. A numerical example shows that the new algorithm is promising.

Key words: bound constraints, trust-region method, line search technique, global convergence.

1. Introduction

In this paper we aim to develop a trust-region type method for solving the following bound-constrained minimization problem.

$$\begin{aligned} &\text{minimize} \quad f(x) \\ &\text{subject to} \quad l \le x \le u, \end{aligned} \tag{1.1}$$

where $f: R^n \to R$ is continuously differentiable, $l \in (R \cup \{-\infty\})^n$, $u \in (R \cup \{\infty\})^n$, $l < u$. We denote the feasible set as $X = \{x \mid l \le x \le u\}$ and the strict interior feasible set as $X^0 = \{x \mid l < x < u\}$.

Trust-region methods for solving the bound-constrained minimization problem (1.1) have been studied extensively, (see [3]–[6]). We pay more attention to the trust-region methods proposed by Coleman and Li [3], Dennis and Vicente [6]. At kth iteration, by introducing a diagonal matrix, [3] presented a trust-region subproblem, which consisted of minimizing a

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