Branch and Prune Techniques in Multidimensional Interval Global Optimization Algorithms [6]

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Interval global optimization algorithms based on branch-and-bound methods provide guaranteed and reliable solutions for the problem

$$\min_{x \in X} f(x),$$

where the objective function $f : D \subseteq \mathbb{R}^n \to \mathbb{R}$ is continuously differentiable and $X \subseteq D$ is the search box representing bound constraints for x.

In these kinds of algorithms there are some classical methods to reject subregions in which the optimum can be guaranteed not to lie. These methods are the cut-off test, the monotonicity test, the range check, the concavity test and so on. Recently many papers ([3, 4, 5]) have studied some new pruning techniques to improve the efficiency of the main algorithm. These methods use the gradient or slope information (i.e first order information) to construct such a technique which can prune the searching interval. All of these works developed the pruning methods for one dimensional case only. However, in [2] there is a suggestion to extend these methods to the multidimensional case with a componentwise approach, where in particular the multidimensional pruning step using slopes have been traced back to the one dimensional case.

In this work we develop the multidimensional extension of the derivative pruning step based on [4], the componentwise extension of the linear boundary value form [1] and its pruning. The multidimensional kite enclosure and its pruning effect will be presented. The test results on 20 standard test functions will be given to compare the performance of these new methods.

References

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Available at: `http://www.inf.u-szeged.hu/~tvinko/kite.ps.gz`

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