

The Effect of Hessian Evaluations in the Global Optimization α BB Method

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Abstract: To find a tight convex underestimator of an objective function is an essential problem in global optimization since it enables to easily compute a lower bound on the global optimal value, among others. In particular, it plays a crucial role in the well-known global optimization α BB method and its variants [1, 2, 3], which have been successfully applied in solving many real-life problems in system identification, optimal control, reactor network synthesis, and biology and chemistry (peptide and protein folding, parameter estimation of dynamic biological systems, chemical equilibrium problems, or molecular structure and cluster prediction).

The α BB method is based by augmenting the original nonconvex function by a relaxation term that is derived from an interval enclosure of the Hessian matrix. In our contribution, we discuss the advantages of symbolic computation of the Hessian. Symbolic computation often allows simplifications of the resulting expressions, which in turn implies less conservative underestimators. We demonstrate by numerical examples that even a small manipulation with the symbolic expressions, which can be processed automatically by computers, can have a large effect on the quality of underestimators. We also show that linearization of nonlinear terms in α -computation can further improve performance of the α BB method.

References

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