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DC programming and DCA for solving Brugnano-Casulli piecewise linear systems

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Abstract

Piecewise linear optimization is one of the most frequently used optimization models in practice, such as transportation, finance and supply-chain management. In this paper, we investigate a particular piecewise linear optimization that is optimizing the norm of piecewise linear functions (NPLF). Specifically, we are interested in solving a class of Brugnano-Casulli piecewise linear systems (PLS), which can be reformulated as an NPLF problem. Speaking generally, the NPLF is considered as an optimization problem with a nonsmooth, nonconvex objective function. A new and efficient optimization approach based on DC (Difference of Convex functions) programming and DCA (DC Algorithms) is developed. With a suitable DC formulation, we design a DCA scheme, named ℓ_1-DCA, for the problem of optimizing the ℓ_1-norm of NPLF. Thanks to particular properties of the problem, we prove that under some conditions, our proposed algorithm converges to an exact solution after a finite number of iterations. In addition, when a non-global solution is found, a numerical procedure is introduced to find a feasible point having a smaller objective value and to restart ℓ_1-DCA at this point. Several numerical experiments illustrate these interesting convergence properties. Moreover, we also present an application to the free-surface hy-

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