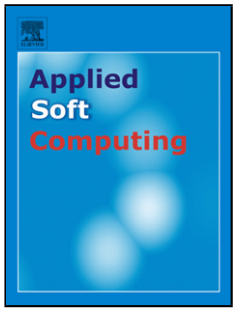

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Self-adjusting parameter control for surrogate-assisted constrained optimization under limited budgets

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Abstract

Constrained optimization of high-dimensional numerical problems plays an important role in many scientific and industrial applications. Function evaluations in many industrial applications are severely limited and often only little analytical information about objective function and constraint functions is available. For such expensive black-box optimization tasks, the constraint optimization algorithm COBRA (**C**onstrained **O**ptimization **B**y **R**adial Basis Function **A**pproximation) was proposed, making use of RBF (radial basis function) surrogate modeling for both objective and constraint functions. COBRA has shown remarkable success in solving reliably complex benchmark problems in less than 500 function evaluations. Unfortunately, COBRA requires careful adjustment of parameters in order to do so.

In this work we present a new algorithm SACOBRA (Self-Adjusting COBRA), which is based on COBRA and capable of achieving high-quality results with very few function evaluations and no parameter tuning. It is shown with the help of performance profiles on a set of benchmark problems (G-problems, MOPTA08) that SACOBRA consistently outperforms COBRA algorithms with different fixed parameter settings. We analyze the importance of the new elements in SACOBRA and show that each element of SACOBRA plays a role to boost up the overall optimization performance. We discuss the reasons and get in this way a better understanding of high-quality RBF surrogate modeling.

Keywords:
optimization; constrained optimization; expensive black-box optimization; radial basis function; self-adjustment

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