An Object Oriented Library for Computing the Range of the Objective Function

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The problem of the efficient computation of the range of the objective function frequently arises in the global deterministic optimization. There are many ways to evaluate such bounds: interval analysis methods, Lipschitz estimators, concave minorants, and many others. These estimates are often implemented by developers manually, which significantly increases the development time and also increases the likelihood of errors in code. In this paper we address this issue by developing the C++ library that automates the computation of function bounds.

The main idea of the proposed approach is to use a single description of a function for a subsequent automatic calculation of the value of the objective function at a given point, derivatives, and interval estimates. The description of a function is constructed with the help of overloaded C++ operators and looks very similar to its algebraic representation. The tool includes the following modules: the mathematical expressions module, the objective function calculation module, the interval analysis module, the gradient calculation module, the interval estimation of gradient module, the Hessian matrix calculation module.

With the help of the developed library the test suite of 150 test optimization problems has been implemented. All functions are implemented by employing the mathematical expressions module. The test suite can be used in testing and comparing global optimization methods.