An escape-from-local minima technique in unconstrained optimization using a grid-like approach and interval equations

Ioannis A. Nikas, and Theodoula N. Grapsa
Division of Computational Mathematics and Informatics,
Department of Mathematics, University of Patras,
GR 265 04 Rio, Greece,
nikas@math.upatras.gr,grapsa@math.upatras.gr

Key words: Global Optimization, grid-like technique, interval equations, escape from local minima.

A common problem in unconstrained optimization methods is their entrapment to a local minimum. In this work, the issue of escaping from such local minima, which are lying inside a given region, is considered. The main idea of this work consists, firstly, in using any optimization method to find a local minimum. Then the initial unconstrained optimization problem is restricted in a bounded rectangular region and over this region it is transformed to an equivalent one, which has the form of an interval equation. The interval zeros obtained from the above interval equation will enclose the global minima and, generally, several local ones. Finally, the used optimization method could be restarted to seek new ”better” local minimizers, using as initial guess a point inside a found interval zero. It is proved that the existence of at least a subset of an interval zero of the corresponding interval equation is enough to decide that the already found minimum is not the global one with certainty. The opposite, that is, the found minimum is the global one, cannot be said. It is clear that any point inside a subset of an interval zero may trigger the method to a new ”better” local minimum. However, the isolation of an interval zero or a subset of an interval one is not a straightforward process. To avoid solving interval equations, a grid-like technique is proposed to overestimate the interval zeros or parts of them. The proposed idea is tested using the BFGS method, as implemented in the optimization toolbox of Matlab, on some well known test functions, with promising results.