AN APPROACH TO GLOBAL OPTIMIZATION BASED ON MULTIDIMENSIONAL ADAPTIVE GRIDS[1]

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The talk is devoted to methods for generation of adaptive interpolation grids for multidimensional numerical optimization. We study extremal problems of the form: Minimize $f(x)$ over the set

$$D = \{x \in \mathbb{R}^n : \underline{x} < x < \overline{x}\}.$$

Here, $\underline{x}, \overline{x} \in \mathbb{R}^n$ are given vectors. Under the lack of a priori information about analytical properties of the function f, we meet a problem with a so-called "black-box" cost function [2]. In numerical algorithms for such global optimization problems, computing time (i.e. an average calculation interval of a value of the function) is customary high, and plays a crucial role.

Adaptive grids is a popular issue in numerical mathematics (see, e.g., [1]). The feature of such grids is their irregularity: Nodes of a grid are crowded in neighborhoods of critical points of a cost function, while in the remainder of D, the grid can be left rather sparse. As a rule, this leads to a tangible raise of algorithms' efficiency.

The proposed approach employs a modified Sheppard function [3] as a reference function. Introduce a set $\mathcal{D} = \{x_k : \ x_k \in D, \, k = \overline{1, N_{\mathcal{D}}}\}$ of randomly chosen points. The modified Sheppard function $F_S(\cdot; \mathcal{D})$ is defined as follows [3]: On $\mathcal{D}$ it coincides with f, and on $D \setminus \mathcal{D}$ it is given by the formula

$$F_S(x; \mathcal{D}) = \sum_{k=1}^{N_{\mathcal{D}}} \frac{f_k + a_k(x - x_k)}{\|x - x_k\|^4} \Bigg/ \sum_{k=1}^{N_{\mathcal{D}}} \frac{1}{\|x - x_k\|^4}.$$

Here, $f_k = f(x_k)$, and $a_k \in \mathbb{R}$ are coefficients of inclination angles of the function F_S at points $x_k \in \mathcal{D}$.

In the talk we discuss results of numerical implementation of problems from collection [4]. The proposed approach makes sense in ravine unimodal, and multiextremal problems.

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