LOBACHEVSKY UNIVERSITY

Comparison of dimensionality reduction schemes for derivative-free global optimization algorithms

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Problem statement

$$\min\{f(y) : y \in D\}, D = \{y \in \mathbb{R}^n : a_i \leqslant y_i \leqslant b_i, 1 \leqslant i \leqslant n\},$$

where $f(y)$ is a vector-function.

Solution of the problem is a set of non-dominated points (Slater set):

$$S(D) = \{y \in D : \nexists z \in D, f_i(z) < f_i(y), 1 \leqslant i \leqslant m\}$$

Assume objectives to satisfy Lipschitz condition in D:

$$|f_i(y_1) - f_i(y_2)| \leqslant L_i \|y_1 - y_2\|, y_1, y_2 \in D, 0 < L_i < \infty, 1 \leqslant i \leqslant m$$

Dimension reduction

Peano-type curve $y(x)$ allows to reduce dimension of the original multi-objective problem:

$$\{y \in \mathbb{R}^N : -2^{-1} \leqslant y_i \leqslant 2^{-1}, 1 \leqslant i \leqslant N\} = \{y(x) : 0 \leqslant x \leqslant 1\}$$
$$\min\{f(y) : y \in D\} = \min\{f(y(x)) : x \in [0,1]\}$$

Conclusion and future work

Already done:

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Future work:

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Q&A

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