Nonlinear Dynamics and Systems Theory, **23** (2) (2023) 183–194

Global Optimization Method of Multivariate non-Lipschitz Functions Using Tangent Minorants

Djaouida Guettal *, Chahinez Chenouf and Mohamed Rahal

Laboratory of Fundamental and Numerical Mathematics (LMFN), Department of Mathematics, University of Ferhat Abbas Setif 1, Algeria.

Received: January 12, 2023; Revised: March 20, 2023

Abstract: This paper deals with the multidimensional global optimization problem where the objective function f is non-Lipschitz over a hyper-rectangle of $\mathbb{R}^n$. The generalization of Piyavskii's algorithm to the multivariate case requires finding the intersection of many non-linear hyper-surfaces. In this paper, we propose an algorithm which is composed of two steps. The first one is to transform the multivariate function f into a single variable function $\mathbf{f}(t)$ using the α-dense curves and the second one is to apply the extended version of Piyavskii's algorithm to $\mathbf{f}(t)$. For minimizing $\mathbf{f}(t)$, we construct a sequence of lower bounding piecewise tangent functions. A convergence result is proved and the numerical experiments on some test functions are given and compared with the existing methods.

Keywords: *global optimization; non-Lipschitz multivariate functions; lower bounding function; Piyavskii's algorithm.*

Mathematics Subject Classification (2010): 93-03, 93A30, 93B40, 93C35, 90C26.

1 Introduction

Let us consider the box constrained global optimization problem

$$\min_{x\in\mathbf{P}=\prod_{i=1}^{n}[a_i,b_i]} f(x), \tag{P}$$

where f is a real continuous multi-extremal function defined on the hyper-rectangle $\mathbf{P}$ and satisfies the following condition:

$$|f(x)-f(y)| \le h\,\|x-y\|^{1/m}, \qquad \forall x,y\in\mathbf{P}, \tag{1}$$

* Corresponding author: mailto:djaouida.guettal@univ-setif.dz