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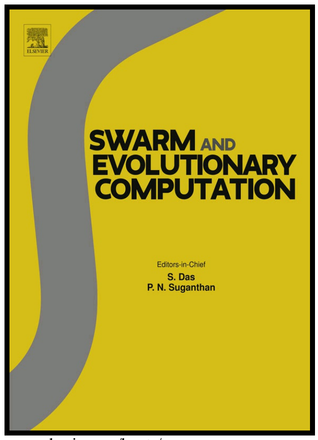

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Weibull-Based Scaled-Differences Schema for Differential Evolution

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Abstract

Differential Evolution is one of the most efficient real-parameter optimization algorithm. It is based on the application of the scaled difference of a pair of population members to another population member, all of them distinct. Diverse variants have been proposed within this schema. In this work, the statistical distribution of these differences of high-performance variants of differential evolution is modelled through a Weibull probability distribution. From the application of this model to diverse differential evolution variants and benchmark functions, a pattern for the most efficient variants can be drawn. As a consequence, a variant where the scaled differences are replaced by random numbers generated from a Weibull distribution is proposed and evaluated.

Keywords: Differential Evolution, Performance, Weibull Probability Distribution

1. Introduction

Differential Evolution (DE) is one of the most popular and efficient real-parameter optimization algorithm [1, 2]. It is based on perturbing the population members of each generation with other population member, randomly selected, and the scaled difference of a pair of members, being all these members distinct. The alteration of the population is achieved through two operators: the Mutation operator (Eq. 1) and the Crossover operator (Eq. 2).

The Mutation operator generates an intermediate population of vectors or members based on the addition of a scaled difference of two randomly-selected vectors, $F \cdot (\vec{x_2} - \vec{x_3})$, over a third randomly-selected vector, $\vec{x_1}$ (base vector), in such a way that $\vec{x_1}$, $\vec{x_2}$, and $\vec{x_3}$ are mutually exclusive, being F a scalar. The mutation factor, F, quantifies the amount of alteration supplied to the base vector. The vectors generated by the mutation operators are termed *donor* or *mutant vectors*.

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