# A Self-adaptive Artificial Bee Colony Algorithm with Symmetry Initialization

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## Abstract[1]

The Artificial Bee Colony (ABC) algorithm is an optimization algorithm inspired by the foraging behavior of bee swarms. Existing research has shown that the ABC algorithm is an effective and robust population-based method which can be used to solve various real-world optimization problems. However, similar to many evolutionary algorithms, there is still a main limitation in ABC, i.e., in many problems, ABC is good at exploration but poor at exploitation. Thus, in order to overcome this limitation and improve the performance of ABC when dealing with various kinds of optimization problems, we proposed a self-adaptive artificial bee colony algorithm with symmetry initialization (SABC-SI). In our SABC-SI algorithm, a novel population initialization method based on half space and symmetry is designed, and such method can increase the diversity of initial solutions. Besides, a self-adaptive search mechanism which is employed in ABC and several new Candidate Solution Generating Strategies (CSGSes) have also been developed. So, the evolutionary strategies can not only be selected dynamically according to their search performance, but also be enhanced. Moreover, the selection operator is improved by eliminating a part of the poor solutions and making good use of the two best solutions in both the current and previous generations. The novel algorithm was tested on 25 different benchmark functions. The experimental results show that SABC-SI outperforms several state-of-the-art algorithms, which indicates that it has great potential to be applied to a wide range of optimization problems.

**Key Words:** Artificial Bee Colony, Self-adaptive, Population initialization, Selection Strategy.

## 1. Introduction

Because the evolutionary algorithms (EAs) have few parameters and they can be easily applied to various problems, many researchers have devoted to the study of EAs over the last three decades. Compared with other traditional methods, EAs have become well-established global optimization methods, and they all have high robustness and broad applicability. Possessing the characteristics of self-organizing and self-learning, EAs can deal with those challenging optimization problems which otherwise cannot be effectively solved by traditional optimization methods. The popular EAs, including genetic algorithm (GA) [1], particle swarm optimization (PSO) [2], differential evolution (DE) [3], ant colony optimization (ACO) [4], and artificial bee colony (ABC) [5], have excellent ability to handle many complex real-world optimization problems.

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