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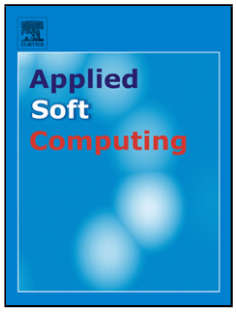

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Authors: Soheila Ghambari, Amin Rahati

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An improved artificial bee colony algorithm and its application to reliability optimization problems

Soheila Ghambari[a], Amin Rahati[a,*]
[a] Department of Computer Sciences, University of Sistan and Baluchestan, Zahedan, Iran[1].

Abstract. Artificial bee colony (ABC) algorithm is a well-established swarm optimization technique that has been successfully applied for solving different kinds of optimization problems. In spite of its efficiency and wide use, ABC still suffers from slow convergence speed. To overcome this insufficiency, an improved version of ABC algorithm called IABC has been proposed in this paper. First, the proposed IABC incorporates a probabilistic population size reduction mechanism in order to accelerate the convergence speed. This mechanism transfers high quality solutions to the next cycle of the algorithm and discards the rest. Second, in addition to the original search operator of ABC, the IABC utilizes a new search operator which enhances the exploitation capability. This new search operator generates a new solution based on a randomly selected pair of solutions and the current best solution. Third, to better balance the trade-off between exploration and exploitation, the IABC unifies the employed and onlooker bee phases into an improved bee phase by using a self-adaptive probabilistic selection scheme. This helps the IABC to decide either to apply the original or the new search operator to produce a new solution. The performance of IABC is evaluated against CEC2014 test suite and eight well-known reliability optimization problems. Numerical experiments indicate that the IABC provides competitive results compared to several state-of-the-art algorithms in terms of convergence speed, robustness, and solution accuracy. Moreover, the IABC considerably improves the best-known solution for one reliability optimization problem.

Keywords: Artificial bee colony algorithm, Population size reduction mechanism, CEC2014 test suite, Reliability optimization problems.

Graphical abstract

* Corresponding author. Tel.: +98 (54)31136275; fax: +98 (54)33431070.
Email addresses: ghambari.soheila@gmail.com, amin.rahati@gmail.com

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