

HYBRIDIZATION STRATEGIES IN SWARM INTELLIGENCE: THE CASE OF ABC–FA AND ABC–RUN ALGORITHMS

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ABSTRACT

Metaheuristic optimization algorithms have become a very popular field of study in recent years due to their ability to effectively solve complex, multidimensional problems. In this study, the Artificial Bee Colony (ABC), Firefly Algorithm (FA), and Runge–Kutta (RUN) optimization algorithms, known for their good performance among metaheuristic methods, are compared with their hybrid variants ABC_RUN and ABC_FA. Five widely used benchmark functions were selected for performance evaluation, and the performance results of the algorithms were statistically evaluated using the Wilcoxon signed-rank test. Furthermore, convergence curves were generated to show the average performance of the algorithms, and average running times were calculated to examine the balance between accuracy and computational cost. The findings show that hybrid methods provide higher accuracy compared to classical methods, while the RUN algorithm has an advantage in terms of running time. This comparative analysis demonstrates that hybrid approaches can more effectively balance exploration and exploitation, increase global optimization performance, and are applicable to real-world problems.

Keywords: metaheuristic optimization, hybrid algorithms, artificial bee colony, firefly algorithm, runge kutta optimization