ECTI Transactions on Computer and Information Technology
Journal homepage: https://ph01.tci-thaijo.org/index.php/ecticit/
Published by the ECTI Association, Thailand, ISSN: 2286-9131

A Performance of AFIRO among Asynchronous Iteration Strategy Metaheuristic Algorithms

Tasiransurini Ab Rahman[1], Nor Azlina Ab. Aziz[2] and Zuwairie Ibrahim[3]

ABSTRACT

Asynchronous Finite Impulse Response Optimizer (AFIRO) is a metaheuristic algorithm that has been developed as a population-based solution with an asynchronous update mechanism. AFIRO is inspired by the Ultimate Unbiased Finite Impulse Response filter framework. AFIRO works with a group of agents where each agent performs the iteration update asynchronously. In the original paper, AFIRO was compared with the Particle Swarm Optimisation algorithm, Genetic Algorithm, and Grey Wolf Optimizer. Although AFIRO shows a better performance, the comparison seems unfair since the iteration strategy of AFIRO is different from those compared algorithms. Hence, this article further investigates the potential of AFIRO against three existent metaheuristic algorithms with the same iteration strategy, namely Asynchronous PSO (A-PSO), Asynchronous Gravitational Search Algorithm (A-GSA), and Asynchronous Simulated Kalman Filter (A-SKF). The CEC2014 test suite was applied to evaluate the performance, where the results revealed that AFIRO leads 18 out of 30 functions. The Holm post hoc showed that AFIRO performs significantly better than A-SKF and A-GSA while having the same performance as A-PSO. Moreover, the Friedman test disclosed that AFIRO has the highest ranking than A-PSO, A-SKF, and A-GSA. Therefore, it can be concluded that AFIRO performs well in the same iteration strategy category.

Article information:

Keywords: Asynchronous Iteration Strategy, Finite Impulse Response, Metaheuristic Algorithm, Population-Based

Article history:
Received: March 3, 2023
Revised: June 3, 2023
Accepted: July 3, 2023
Published: July 22, 2023
(Online)

DOI: 10.37936/ecti-cit.2023173.251829

1. INTRODUCTION

The iteration strategy is important for population-based metaheuristic algorithms. It specifies the sequence of search steps for agents, considering each other in updating a solution. The iteration strategy can be classified into synchronous and asynchronous updates [1]–[3]. The synchronous update is commonly implemented in most population-based algorithms such as the Honey Badger Algorithm [4], Golden Eagle Optimizer [5], Arithmetic Optimisation Algorithm [6], Carnivorous Plant Algorithm [7], and Black Widow Optimisation Algorithm [8]. Pseudocode 1 shows a general procedure of population-based metaheuristic algorithms. To note, the iteration strategy distinguishes steps 2 and 3.

Pseudocode 1

1 : Randomly initialize possible solutions
2 : Evaluate the current solution
3 : Generate the next possible solution
4 : **While** not stopping conditions **do**
Repeat steps no.2 and no.3
End the algorithm
5 : Return the best-found solution

In a synchronous update, both steps are executed as a group (population) where step 2 needs to be completed by the entire members first before step 3 can be performed. All agents consider the performance of all members before improving (updating) the solution. As an advantage, the agents from a synchronous update are good in exploitation [9] in which the agents

[1] The author is with Computational, Signal, Imaging and Intelligence Focus Group, Department of Electronic Engineering, Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia, 86400, Johor, Malaysia, E-mail: surini@uthm.edu.my
[2] The author is with Center for Engineering Computational Intelligence, Faculty of Engineering and Technology, Multimedia University, 75450, Melaka, Malaysia, E-mail: azlina.aziz@mmu.edu.my
[3] The author is with College of Engineering, Universiti Malaysia Pahang, 26600 Pahang, Malaysia, E-mail: zuwairie@ump.edu.my