RAIRO-Oper. Res. 52 (2018) 429–438
https://doi.org/10.1051/ro/2017037

RAIRO Operations Research
www.rairo-ro.org

CONVERGENCE ANALYSIS OF THE PLANT PROPAGATION ALGORITHM FOR CONTINUOUS GLOBAL OPTIMIZATION

Nassim Brahimi[1,*], Abdellah Salhi[2] and Megdouda Ourbih−Tari[3]

Abstract. The Plant Propagation Algorithm (PPA) is a Nature-Inspired stochastic algorithm, which emulates the way plants, in particular the strawberry plant, propagate using runners. It has been experimentally tested both on unconstrained and constrained continuous global optimization problems and was found to be competitive against well established algorithms. This paper is concerned with its convergence analysis. It first puts forward a general convergence theorem for a large class of random algorithms, before the PPA convergence theorem is derived and proved. It then illustrates the results on simple problems.

Mathematics Subject Classification. 90C09, 05C15.

Received August 28, 2016. Accepted May 6, 2017.

1. Introduction

In recent years, a number of random search algorithms, the so-called heuristic and meta-heuristic algorithms, have been suggested for optimization. They are popular because they are easy to understand and implement, and they work well in practice although they do not guarantee optimality. Theoretical conditions under which convergence to the global optimum is achieved, can be derived.

In the class of biologically inspired optimization algorithms, there are several types (Brownlee [6]; Yang [28]). The Flower Pollination Algorithm (FPA) is inspired by the pollination of flowers through different agents such as insects (Yang [29]); the Swarm Data Clustering (SDC) algorithm is inspired by the pollination of flowers by bees (Kazemian *et al.* [17]); Particle Swarm Optimization (PSO) is inspired by the foraging behaviour of groups of animals and insects (Eberhart and Kennedy [9]; Clerc [7]) the Artificial Bee Colony (ABC) algorithm simulates the foraging behaviour of honeybees (Karaboga [15]; Karaboga and Basturk [16]); the Firefly algorithm is inspired by flashing fireflies to attract a mate (Yang [27]; Gandomi *et al.* [10]); the Social Spider Optimization (SSO) algorithm is inspired by the cooperative behaviour of social spiders (Cuevas and Cienfuegos [8]). The list can easily be extended.

Keywords. Strawberry algorithm, randomised algorithms, convergence analysis, global optimisation.

[1] Laboratoire de Mathématiques Appliquées, Faculté des Sciences Exactes, Université de Bejaia, 06000, Bejaia, Algeria.
*Corresponding author: nassim.brahimi@univ-bejaia.dz

[2] Department of Mathematical Sciences, Faculty of Science and Health, University of Essex, CO4 3SQ, United Kingdom.

[3] Institut des Sciences et de la Technologie, Centre Universitaire Morsli Abdellah de Tipaza, 42000, Tipaza, Algeria.

Article published by EDP Sciences