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A NEW COOPERATIVE CO-EVOLUTIONARY MULTI-OBJECTIVE ALGORITHM FOR FUNCTION OPTIMIZATION

Sepehr Meshkinfam Fard[1], Ali Hamzeh[2] and Koorush Ziarati[2]

[1]Department of Mathematics
School of Science
[2]CSE and IT Department
School of ECE
Shiraz University
Mollasadra Ave, Shiraz, Iran
Sepehr.meshkinfam@gmail.com; ali@cse.shirazu.ac.ir; ziarati@shirazu.ac.ir

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Abstract. *In this reach work, a well performing approach in the context of multi-objective evolutionary algorithm (MOEA) is investigated due to its complexity. This approach called NSCCGA is based upon a previously introduced approach called NSGA-II. NSCCGA performs better than NSGA-II but with a heavy load of computational complexity. Here, a novel approach called GBCCGA is introduced based on MOCCGA with some modifications. The main difference between GBCCGA and MOCCGA is in their niching technique, i.e., a novel grid-based technique is used in GBCCGA instead of the traditional sharing mechanism in MOCCGA. The results show that GBCCGA performs roughly the same as NSCCGA but with very low computational complexity with respect to the original MOCCGA.*

Keywords: Genetic algorithms, Multi-objective, Grid based, Cooperative, Co-evolutionary, GBCCGA

1. **Introduction.** The basic idea of evolutionary algorithms (EA) [1] is to encode candidate solutions for a specific problem into corresponding chromosomes and then evolve these chromosomes via some iterative recombination and selection phases to achieve the best possible chromosome and decode it as the resulting solution.

Genetic algorithm is a well-known family in the area of EA which has been designed and developed by John Holland in 1960s. There exist three main phases in the evolution process of GA: crossover or recombination, mutation and the selection phases, where crossover and mutation are responsible to produce new chromosomes and selection tries to select best of them.

A multi-objective problem is a kind of problem where the goal is to achieve m objective functions simultaneously, and may concern the minimization of all m functions or a combination of minimization and maximization of those m functions.

Genetic algorithms are well-known problem solvers in the area of multi-objective optimization. Fonseca and Fleming [3] have represented the idea of the relationship between the fitness function used in GA and the Pareto optimality concept [6] used in multi-objective optimization. Since then, several methods in usage of genetic algorithm to solve multi-objective problems have been composed such as those mentioned in [1].

A co-evolutionary genetic algorithm is a kind of evolutionary algorithm in which fitness of a candidate individual is evaluated based on the relationship between candidate individual and others. One of these techniques called MOCCGA, which will be explained further, is based on using the co-operative co-evolutionary GA in the search process. In