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AN ADAPTIVE BACTERIAL FORAGING ALGORITHM FOR CONSTRAINED OPTIMIZATION

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Abstract. *Attacking the constrained optimization problems with the meta-heuristics techniques has been a popular research topic during the past decade. In this paper, we propose an Adaptive Bacterial Foraging Algorithm (ABFA) with the good nodes set-based crossover operator. The good nodes set is utilized here for initializing the bacteria population, constructing the crossover operator, and dispersing the similar individuals in the ABFA. A novel adaptive computational chemotaxis is incorporated into our algorithm as well. A hybrid selection approach based on the Pareto-dominance and tournament selection can effectively retain the best individuals in the population. We examine the proposed ABFA using 11 well-known test functions, and compare its performances with other constrained optimization methods. Three interesting engineering design problems are also used to verify the efficiency of our ABFA.*
Keywords: Bacterial foraging optimization, Good nodes set, Constrained optimization, Pareto-dominance

1. **Introduction.** Optimization is a computational science that studies techniques for finding the 'best' solutions. It has been widely employed in a large variety of fields, including transportation, manufacturing, physics, and medicine [1,2]. The swarm intelligence methods are promising solutions to these challenging optimization problems [3,4]. Dealing with the constrained optimization problems using the Evolutionary Algorithms (EA) [5,6], such as Particle Swarm Optimization (PSO) [7,8], Artificial Immune Systems (AIS) [9,10], Harmony Search (HS) [11] and other meta-heuristics methods [12,13], has also attracted great interest during the recent years. The Bacterial Foraging Optimization (BFO) is a novel biology-inspired technique developed by Passino [14]. The BFO stems from the study of the E. coli chemotaxis behaviors, and has been found to be highly competitive in solving the unconstrained optimization problems [15]. As a matter of fact, the BFO has been successfully applied in numerous engineering areas, e.g., optimal controller design [14], harmonic estimation [16], identification of nonlinear dynamic systems [17], and training of artificial neural networks [18].

An Adaptive Bacterial Foraging Algorithm (ABFA) is proposed in this paper, in which a good nodes set-based crossover operator is utilized. Our new optimization approach has a few remarkable features: (1) It uses the good nodes set to generate the initial population and new bacteria. The crossover operator employed is also based on the