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Honey-Bees Mating Optimization (HBMO) Algorithm: A New Heuristic Approach for Water Resources Optimization

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Abstract. Over the last decade, evolutionary and meta-heuristic algorithms have been extensively used as search and optimization tools in various problem domains, including science, commerce, and engineering. Their broad applicability, ease of use, and global perspective may be considered as the primary reason for their success. The honey-bees mating process may also be considered as a typical swarm-based approach to optimization, in which the search algorithm is inspired by the process of real honey-bees mating. In this paper, the honey-bees mating optimization algorithm (HBMO) is presented and tested with few benchmark examples consisting of highly non-linear constrained and/or unconstrained real-valued mathematical models. The performance of the algorithm is quite comparable with the results of the well-developed genetic algorithm. The HBMO algorithm is also applied to the operation of a single reservoir with 60 periods with the objective of minimizing the total square deviation from target demands. Results obtained are promising and compare well with the results of other well-known heuristic approaches.

Key words: honey-bees mating optimization, genetic algorithm, heuristic search, non-linear optimization, single-reservoir operation

Introduction

Traditional optimization search methods may be classified into two distinct groups: direct-search and gradient-based search methods. In direct-search methods, only the objective function and constraint values are used to guide the search strategy, whereas gradient-based methods use the first and/or second-order derivatives of the objective function and/or constraints to guide the search process. Since derivative information is not used, direct-search methods usually require many function evaluations for convergence. For the same reason, they can also be applied to a variety of problems without a major change in the algorithm. In contrast, gradient-based methods often quickly converge to an optimal solution, but are not efficient in non-differentiable or discontinuous problems. In addition, there are some common