Multi objective barnacle mating optimization for control design of a pendulum system

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ABSTRACT
This paper presents a MultiObjective Barnacle Mating Optimization (MOBMO) and its application to optimize controller parameters for an inverted pendulum system. The algorithm is an extended version of a single-objective Barnacle Mating Optimization (BMO). In terms of solving a complex problem that has two conflicting objectives, a multiobjective type BMO is needed. Therefore, in the proposed MOBMO, nondominated sorting and crowding distance approaches are incorporated into BMO as a technique to formulate the multiobjective algorithm. The proposed algorithm is tested on various multiobjective benchmark functions. Its performance in terms of accuracy and diversity attainment to find a theoretical pareto front solution is analyzed. Moreover the proposed MOBMO is applied to optimize control parameters for PD controls of a pendulum system. The performance of the proposed MOBMO is compared with Multiobjective Water Cycle Algorithm (MOWCA). Result of the benchmark functions test shows that the proposed algorithm has attained a higher accuracy and a competitive diversity in locating the theoretical front solution. For its application to optimize PD control parameters, both MOWCA and MOBMO have successfully attained a good pareto front solution and controlled the pendulum sufficiently good. Overall performance, the proposed MOBMO has outperformed MOWCA for accuracy attainment and achieved the same level of diversity performance.

KEYWORDS
Barnacle mating optimization; MOBMO; Multiobjective optimization; PD control; Pendulum

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