

Sine-Based Barnacle Mating Optimization for PD Control of an Inverted Pendulum System



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Abstract This paper presents an improved optimization algorithm namely Sine-based Barnacle Mating Optimization (SbBMO) algorithm. The Barnacle Mating Optimization (BMO) applies a Barnacle mating concept in retaining the survival of their colony in its strategy. A Sine-based position update strategy is applied to all barnacles that are located at a distance away from their parent. This is to guide the barnacles towards the current best barnacle in the colony. It balances the mating strategy considering the dynamic step size of the sine-based strategy. The proposed SbBMO is tested on 10 dimensions of CEC2014 benchmark functions. The proposed algorithm is also applied to optimize Proportional-Derivative (PD) controller for controlling an inverted pendulum system. Result of the benchmark functions shows that the proposed SbBMO achieved a significant improvement on accuracy performance. For the inverted pendulum application, both algorithms have satisfactorily optimized the controller. However, the SbBMO-based PD achieved a more satisfactory control performance as compared to BMO-based PD.

Keywords Barnacle Mating Optimization · Sine based algorithm · Inverted pendulum system · PD control

1 Introduction

Optimization algorithm is a promising tool used to solve many complex real-world problems in various fields. In recent applications, it was used to solve control problem of a wind farm energy [2], modelling and control of a robotic system [2] and controlling a wheeled chair for disable person [3]. Due to a certain limitation of a searching strategy, an optimization algorithm can perform very well to some problems, but can only perform sufficiently well for some other problems. This made many researchers around the world keep on searching a better strategy to produce more algorithms that have a better performance. In an optimization algorithm research, it is a common trend

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