A modified bats echolocation-based algorithm for solving constrained optimisation problems

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Abstract: A modified adaptive bats sonar algorithm (MABSA) is presented that utilises the concept of echolocation of a colony of bats to find prey. The proposed algorithm is applied to solve the constrained optimisation problems coupled with penalty function method as constraint handling technique. The performance of the algorithm is verified through rigorous tests with four constrained optimisation benchmark test functions. The acquired results show that the proposed algorithm performs better to find optimum solution in terms of accuracy and convergence speed. The statistical results of MABSA to solve all the test functions also has been compared with the results from several existing algorithms taken from literature on similar test functions. The comparative study has shown that MABSA outperforms other establish algorithms, and thus, it can be an efficient alternative method in the solving constrained optimisation problems.

Keywords: modified adaptive bats sonar algorithm; MABSA; bats echolocation; constrained optimisation problems.


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1 Introduction

Constrained optimisation problems normally come with lack of explicit mathematical formulation but have discrete definition domains, mixed of continuous and discrete design variables and also strong nonlinear objective functions with multiple complex constraints (Garg, 2014). However, due to computational drawbacks and the requirement of substantial gradient information traditional numerical programming strategies are incapable to solve constrained optimisation problems consistently (Sadollah et al., 2013). The alternative prospect to attain constrained optimisation problems is by metaheuristic methods (Hsieh, 2014).

Among most popular metaheuristic methods are swarm intelligence algorithms. These algorithms are inspired from the collective behaviour of swarms through complex interaction between individuals and its neighbourhood with nature (Hsieh, 2014). The most remarkable parts in any swarm intelligence algorithms are that the algorithm has advantages of memory, diverse multi-characters capability, rapid solution improvement mechanism and adaptable to internal and external changes (Garg, 2014). Particle swarm optimisation (PSO), artificial bee colony (ABC), ant colony