

A hybrid modified method of the sine cosine algorithm using latin hypercube sampling with the cuckoo search algorithm for optimization problems

Abstract

The metaheuristic algorithm is a popular research area for solving various optimization problems. In this study, we proposed two approaches based on the Sine Cosine Algorithm (SCA), namely, modification and hybridization. First, we attempted to solve the constraints of the original SCA by developing a modified SCA (MSCA) version with an improved identification capability of a random population using the Latin Hypercube Sampling (LHS) technique. MSCA serves to guide SCA in obtaining a better local optimum in the exploitation phase with fast convergence based on an optimum value of the solution. Second, hybridization of the MSCA (HMSCA) and the Cuckoo Search Algorithm (CSA) led to the development of the Hybrid Modified Sine Cosine Algorithm Cuckoo Search Algorithm (HMSCACSA) optimizer, which could search better optimal host nest locations in the global domain. Moreover, the HMSCACSA optimizer was validated over six classical test functions, the IEEE CEC 2017, and the IEEE CEC 2014 benchmark functions. The effectiveness of HMSCACSA was also compared with other hybrid metaheuristics such as the Particle Swarm Optimization–Grey Wolf Optimization (PSOGWO), Particle Swarm Optimization–Artificial Bee Colony (PSOABC), and Particle Swarm Optimization–Gravitational Search Algorithm (PSOGSA). In summary, the proposed HMSCACSA converged 63.89% faster and achieved a shorter Central Processing Unit (CPU) duration by a maximum of up to 43.6% compared to the other hybrid counterparts.

Keyword

Computational intelligence; Cuckoo search; Hybrid algorithm; Metaheuristic; Optimization algorithm; Sine cosine