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Multi-scale quantum harmonic oscillator algorithm for global numerical optimization

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Abstract

This paper aims to provide a novel metaheuristic algorithm motivated from quantum motion entitled Multi-scale Quantum Harmonic Oscillator Algorithm (MQHOA). The calculation accuracy of MQHOA is adjustable. The physical model and mathematical analysis of the proposed algorithm are detailed and well interpreted in this paper. The structure of MQHOA is very simple, including merely two phases, the quantum harmonic oscillator process (QHO process) and multi-scale process (M process). Experiments are carried out to validate the effectiveness and efficiency of MQHOA by applying it to 30 well defined benchmark functions. We also compare MQHOA with several well-known metaheuristic algorithms, such as genetic algorithm (GA), simulated annealing (SA), particle swarm optimization (PSO) and quantum particle swarm optimization (QPSO). The comparative results indicate the competitive and superior performance of the proposed algorithm in both convergence speed and optimal solution accuracy.

Keywords:

Quantum harmonic oscillator algorithm, Quantum algorithm, Metaheuristic algorithm, Stochastic algorithm, Global optimization

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