

学术探讨

多量子粒子群协同优化算法研究

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摘要 针对标准粒子群优化 (PSO) 算法及其改进算法存在的局部收敛与收敛速度问题, 提出了一种多量子粒子群协同优化 (QPSCO) 方法。该算法采用双层的多粒子群协同优化结构: 用多个量子粒子群在底层独立地搜索解空间, 同时引入参数变异策略, 以扩大搜索范围; 上层用1个量子粒子群追逐当前全局最优解, 并对飞离搜索区域粒子的位置用新位置取代, 以加快算法收敛。在此基础上, 将该算法应用于实际控制系统低阶时滞对象的PID控制器设计中。仿真结果表明, QPSCO是一种有效的参数优化算法, 与标准PSO、QPSO等算法相比具有更好的全局收敛性能。

关键词 [粒子群](#) [协同优化](#) [多量子粒子群](#)

分类号

Research on Quantum-behaved Particle Swarms Cooperative Optimization

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Abstract

Aiming at the problem that the simple Particle Swarm Optimization (PSO) algorithm and its improved algorithms are difficult to deal with local convergence and convergence velocity, this paper proposes a Quantum-behaved Particle Swarms Cooperative Optimization (QPSCO) algorithm. In its two-layer framework with particle swarms cooperative optimization, some quantum-behaved particle swarms are employed to search in the solution space independently and a mutation parameter is introduced for larger searching scale in bottom layer, and a single quantum-behaved swarm is employed to track with the globe best solution while new particles replace those particles flying out the solution space with their position in top layer. Based on the above, this algorithm is applied to PID controller design for a lower-order system with time delay. Simulation results demonstrate that the approach is more effective for parameter optimization and have better global convergence ability than PSO, QPSO et al.

Key words [particle swarm](#) [cooperative optimization](#) [quantum-behaved particle swarms](#)

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