

过程系统工程

混合粒子群优化算法及其应用

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摘要

提出了一种通过改进全局最优位置粒子寻优策略而提高粒子群优化计算效率的混合粒子群优化算法。针对流程工业典型设备的状态跟踪预报等有计算时间限制的优化问题, 混合粒子群优化算法在不改变原有粒子群粒子寻优策略的前提下, 将粒子群整体已搜寻到的全局最优位置看作一个特殊的粒子, 令该粒子执行梯度下降寻优的寻优策略。在粒子群的寻优迭代计算中增加全局最优位置粒子单独的梯度下降寻优过程, 从而将粒子群优化算法的全局寻优特性与梯度下降算法的邻域寻优特性相结合, 以提高粒子群优化算法的整体寻优效率, 进而缩短寻优计算的时间。针对流程工业典型设备的实际应用表明, 混合粒子群优化算法能够减少寻优迭代次数, 进而缩短优化计算时间。

关键词

[混合粒子群优化算法](#) [模拟退火](#) [神经网络](#) [连续搅拌反应釜](#)

分类号

Hybrid particle swarm optimization and its application

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Abstract

Hybrid particle swarm optimization was presented to improve the optimizing efficiency of the particle swarm by changing the optimizing strategy of the global best particle. Aimed at the problem of optimization with a limit on computing time, such as the state prediction of a typical equipment in process industry, hybrid particle swarm optimization took the global best position found by the particle swarm as a special particle, which performed the gradient descending optimization. By adding the individual gradient descending optimization of the global best particle to the optimization iterations, the global search and local search were combined in hybrid particle swarm optimization. The hybridism of this new particle swarm optimization improved the optimizing efficiency of the particle swarm, and reduced the time of optimization computing. In the test of a real application, hybrid particle swarm optimization was applied to the state prediction of the continuous stirred tank reactor (CSTR), which is a typical equipment of the process industry. In the test training of neural network that was used in the prediction of the concentration of the CSTR product, hybrid particle swarm optimization took less optimizing iterations than the traditional particle swarm optimization, and took less optimization computing time, which showed that hybrid particle swarm optimization could reduce the computing time of optimization as the original intent of this research.

Key words

[hybrid particle swarm optimization](#) [simulated annealing](#) [neural network](#) [continuous stirred tank reactor](#)

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