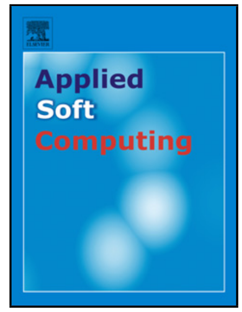
Accepted Manuscript



Title: Improved Global-Best-Guided Particle Swarm Optimization with Learning Operation for Global Optimization Problems

Author: Hai-bin Ouyang Li-qun Gao Steven Li Xiang-yong Kong

PII: S1568-4946(16)30489-6
DOI: http://dx.doi.org/doi:10.1016/j.asoc.2016.09.030
Reference: ASOC 3829

To appear in: *Applied Soft Computing*

Received date: 22-4-2016
Revised date: 16-8-2016
Accepted date: 23-9-2016

Improved Global-Best-Guided Particle Swarm Optimization with Learning Operation for Global Optimization Problems

Hai-bin Ouyang[a]*, Li-qun Gao[b], Steven Li[c], Xiang-yong Kong[d]
[a]School of Mechanical and Electric Engineering, Guangzhou University, Guangzhou, 510006, china
[b]College of Information & Science, Northeastern University, Shenyang 110819, China
[c]Graduate School of Business and Law, RMIT University, Melbourne 3000, Australia
[d]School of Electrical Engineering and Automation, Jiangsu Normal University, Xuzhou 221116, China

* Correspondent: Hai-bin Ouyang, E-mail:oyhb1987@163.com

Highlights

1. In the improved algorithm, according to the original role of the PSO algorithm, the particle population is divided into current population, historical best population and global best population, and each population has corresponding searching strategies.
2. In the current population, global neighborhood exploration strategy is presented to enhance the global exploration capability.
3. A local learning mechanism is used to improve local exploitation ability in historical best population. Different with the former PSO algorithms, each historical best particle can learning from better particles independently.
4. Stochastic learning and opposition based learning operations are employed to accelerate convergence speed and improve optimization accuracy in global best population.
5. The effects of the relevant parameters on the performance of IGPSO have been experimentally investigated. Numerical experiments on some well-known benchmark test functions reveal that IGPSO algorithm outperforms other state-of-the-art intelligent algorithms in terms of accuracy, convergence speed, and nonparametric statistical significance. Moreover, IGPSO performs better for engineering design optimization problems.

Abstract: In this paper, an improved global-best-guided particle swarm optimization with learning operation (IGPSO) is proposed for solving global optimization problems. The particle population is divided into current population, historical best population and global best population, and each population is assigned a corresponding searching strategy. For the current population, the global neighborhood exploration strategy is employed to enhance the global exploration capability. A local learning mechanism is used to improve local exploitation ability in the historical best population. Furthermore, stochastic learning and opposition based learning operations are employed to the global best population for accelerating convergence speed and improving optimization accuracy. The effects of the relevant parameters on the performance of IGPSO are assessed. Numerical experiments on some well-known benchmark test functions reveal that IGPSO algorithm outperforms other state-of-the-art intelligent algorithms in terms of accuracy, convergence speed, and nonparametric statistical significance. Moreover, IGPSO performs better for engineering design optimization problems.

Key words: particle swarm optimization; global exploration capability; convergence speed; accuracy