A NEW QUANTUM PARTICLE SWARM OPTIMIZATION ALGORITHM WITH LOCAL ATTRACTING

D. Shao, S. Hu, Y. Fei

Abstract: This paper proposes a new quantum particle swarm optimization algorithm with local attracting (LAQPSO), which is based on quantum-inspired evolutionary algorithm (QEA) and particle swarm optimization algorithm (PSO). In the proposed LAQPSO, a novel quantum bit expression mechanism called quantum angle is employed to encode the solution onto particle, and a new local attractor is proposed to determine the rotation angle of quantum rotation gate automatically. During the process of seeking the global solution, the magnitude of rotation angle is adjusted by an important parameter called contraction coefficient, which can quantitatively determine the tradeoff between exploration ability and exploitation ability. The simulation results for different contraction coefficients are helpful for selecting the key parameter. A set of benchmark functions are used to evaluate the performance of LAQPSO, QEA and QBPSO, and the results show that the proposed algorithm has a fast convergence rate and can effectively avoid premature convergence.

Key words: *quantum particle swarm optimization, quantum angle, local attractor*

Received: December 13, 2014 **DOI:** 10.14311/NNW.2016.26.028
Revised and accepted: October 6, 2016

1. Introduction

Quantum computing can be viewed as developing algorithms that are derived from the combination of quantum mechanics, computer science and classical information theory [4]. Ever since Benioff [1] presented his quantum Turing machine (QTM) in 1980, the field of quantum computing has begun to be explored. After that, Shor [15] presented a efficient quantum algorithm for factoring integers, and Grover [5] developed a search quantum algorithm, which can provide quadratic speed-up when applied to search problems. All the previous work has proved that many difficult problems in classical computing could be solved efficiently with quantum algorithms.

Quantum computing would be most efficient if run on a quantum computer, as the same do not yet exist, and meantime the quantum simulation on a classical computer has an exponential order overhead. Nevertheless, it is beneficial to introduce

Dong Shao – Corresponding author, Shenghai Hu, Yuting Fei, College of Mechanical and Electrical Engineering, Harbin Engineering University, Harbin 150001, PR China, E-mail: dongshao@hrbeu.edu.cn, hushenghai@hrbeu.edu.cn, 370515242@qq.com

