Editorial

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Swarm intelligence is the discipline that deals with natural and artificial systems composed of many individuals that coordinate their activities using decentralised control and self-organisation. In particular, the discipline focuses on the collective behaviour that results from the local interactions of the individuals with each other and with their environment. Examples of systems studied by swarm intelligence are colonies of ants and termites, schools of fish, flocks of birds, and herds of land animals. Some human artefacts also fall into the domain of swarm intelligence, notably some multi-robot systems, and also certain computer programs that are written to tackle optimisation and data analysis problems.

Since swarm-based computing is a new stochastic optimisation technique, many researchers focus their attentions to this new area. Currently, the research on swarm-based computing generally can be categorised into five parts: algorithms, topology, parameters, merging/combination with other techniques, and applications. Although it achieves many successfully applications, however, it still encounters two main problems:

1. the bad computational efficiency in the later evolutionary stage
2. easily get trapped in a local optimum when solving high dimensional multi-modal problems.

We believe that the series of works in this special issue provide a useful reference for understanding these two problems of PSO mentioned before. In total, seven papers have been selected to reflect the call thematic vision. The contents of these studies are briefly described as follows.

Different from electromagnetism-like (EM), differential evolution (DE), evolutionary algorithm (EA) and particle swarm optimisation (PSO), artificial physics optimisation (APO) is a new optimisation under the physicomimetics framework by simulating Newton's second law. In the paper, 'On mass effects to artificial physics optimisation algorithm for global optimisation problems', L.P. Xie, J.C. Zeng and Z.H. Cui propose a novel variant of APO algorithm. In this paper, several versions of APO algorithm with different mass functions are used to solve two type benchmarks: unimodal and multimodal functions. Simulation results show the mass functions with concave curve may generally obtain the satisfied solution within the allowed iterations.

In the paper, 'Boid particle swarm optimisation', Z.H. Cui and Z.Z. Shi introduce a novel variant of particle swarm optimisation (BPSO) in which cohesion rule and alignment rule are both employed to improve the performance. In BPSO, each particle has two motions: divergent motion and convergent motion. For divergent motion, each particle adjusts its moving direction according to the alignment direction and the cohesion direction, as well as in convergent motion, the original update equation of the standard version of PSO is used.

In the paper, 'Barebones particle swarm for multi-objective optimisation problems', Y. Zhang, D.W. Gong and Y.N. Jiang design a new variant of parameter-free PSO for multi-objective optimisation problems by incorporating the barebones PSO. Furthermore, a special mutation operator that enriches the exploratory capabilities is also introduced. The proposed algorithm is validated using several benchmark test problems and four standard metrics. Results indicate that the proposed algorithm is highly competitive.

Quantum-behaved particle swarm optimisation (QPSO) algorithm is a global convergence guaranteed algorithm. In the paper, 'Using selection to improve quantum-behaved particle swarm optimisation', H.X. Long, J. Sun, X. Wang, C-H. Lai and W.B. Xu employ two selection strategies to improve the performance of QPSO. The first one is QPSO with tournament selection (QPSO-TS) and the other is the QPSO with roulette-wheel selection (QPSO-RS). The experiment results on benchmark functions show that both QPSO-RS and QPSO-TS have better performance and stronger global search ability than QPSO and standard PSO.

Integral-controlled particle swarm optimisation (ICPSO) is a different variant by incorporating two integral controllers to improve the population diversity. However, the performance is heavily dominated by the best location found by the entire swarm. Therefore, X.J. Cai and Y. Tan incorporate the quadratic interpolation method to estimate the exact local optima in their paper entitled 'Individual predicted integral-controlled particle swarm optimisation'. Simulation results show this new variant provide an efficient local search capability than other three variants of particle swarm optimisation when solving multi-modal numerical problems.

In the paper, 'Multi-swarm particle swarm optimiser with Cauchy mutation for dynamic optimisation problems', C.Y. Hu, B. Wang and Y.J. Wang propose a new modification aiming to solve the dynamic optimisation problems. In this new variant, the population is divided into a set of interacting swarms. These swarms interact locally by dynamic regrouping and dispersing. Cauchy mutation is applied to the global best particle when the swarm detects the environment of the change. The numerical experimental results show that the proposed algorithm is an excellent alternative to track dynamically changing optima.

In the paper, 'Optimal ballast scheme design for cargo ships using an improved genetic algorithm', J. Chen, Y. Lin, J.Z. Huo, M.X. Zhang, and Z.S. Ji design an improved genetic algorithm (GA) to optimising the optimal ballast scheme for ocean going cargo ships. In this new variant, a heuristic dynamic adjusting rule was proposed to dynamically adjust the normalising coefficients to balance the convergence speeds of the multiple objectives and make the weight vector work properly. With the proposed method, the design process can be expedited and more accurate schemes can be obtained.

For this special issue, we received abundant responses from researchers. Among them, seven papers were accepted and are included in this special issue. Overall we feel that these papers cover quite a spectrum of, what is, a novel yet highly important research field.