Editorial

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Biographical notes: Xingjuan Cai is an Associate Professor of Computer Science and Technology at the Taiyuan University of Science and Technology, China. She received her MS degree from the Taiyuan University of Science and Technology, China in 2008. She is an editorial board member of *International Journal of Innovative Computing and Applications*. Her interest includes computational intelligence and complex system. She has published over 20 peer reviewed journal papers, ten peer reviewed full conference papers in computational intelligence.

Xiao-Zhi Gao received his BSc and MSc degrees from the Harbin Institute of Technology, China in 1993 and 1996, respectively. He earned his DSc (Tech.) degree from the Helsinki University of Technology (currently Aalto University), Finland in 1999. Since January 2004, he has been appointed as a Docent (Adjunct Professor) at the same university. He is also a Guest/Visiting Professor at the Harbin Institute of Technology, Beijing Normal University, and Shanghai Maritime University, China. He has published more than 350 technical papers on refereed journals and international conferences. His current research interests are nature-inspired computing methods with their applications in optimisation, data mining, machine learning, control, signal processing, and industrial electronics. He is an Associate Editor of the *Applied Soft Computing*, *International Journal of Machine Learning and Cybernetics*, and *Journal of Intelligent Automation and Soft Computing*.

Rajan Alex is a Professor in Computer Science at the West Texas A&M University, Canyon, Texas. He has been with the university for more than 17 years. He earned his PhD in Applied Mathematics and MS in Computer Science from the Texas Tech University. His research interests include applications in artificial neural networks and resolution of problems using fuzzy logic. He has resolved problems in supply chain management, regression analysis, linear and nonlinear programming, and neural networks using fuzzy logic. He has authored and co-authored over 40 publications including journal papers and conference proceedings. He currently serves as the Conference Chair for the 2012 Conference on Computing Science in Colleges (South Central Region). He has also served on the organising committees of several conferences.

Evolutionary multi-objective optimisation (EMO) is a collection of the latest state-of-the-art theoretical research, design challenges and applications in the field of multi-objective optimisation paradigms using evolutionary algorithms. Multi-objective optimisation is concerned with mathematical optimisation problems involving more than one objective function to be optimised simultaneously. Multi-objective optimisation has been applied in many fields of science, including engineering, economics and logistics (see the section on applications for detailed examples) where optimal decisions need to be taken in the presence of trade-offs between two or more conflicting objectives.

We believe that the series of work in this special issue provide a useful reference for learning the current progress on EMO. In total, six papers have been selected to reflect the call of the thematic vision. The contents of these works are briefly described as follows:

In the paper, 'Vehicle routing multi-objective optimisation for hazardous materials transportation based on adaptive double populations genetic algorithm', C. Ma et al. develop the adaptive double populations genetic algorithm to generate the vehicle routing optimisation model for multiple vehicles. Three objectives are introduced in this paper and try to minimise the total risk, cost and the running time of hazardous materials vehicle. Meanwhile, the load constraint, max-risk constraint and time window constraint are also considered. Finally, the double population mechanism and adaptive weighted fitness allocation mechanism are adopted to calculate these fitness values. Case study demonstrates the proposed algorithm is valid and can find a feasible solution. Clearly, the vehicle routing strategy can provide the guidance for hazardous materials transportation decision-making departments and can reduce the possibility of transportation accidents.

Static software defect prediction problem is one crucial problem in software test. In this paper, 'Hybrid algorithm for two-objective software defect prediction problem', a two-objective software defect prediction model is developed based on the hybrid algorithm that combines the benefits of support vector machine (SVM) and cuckoo search approaches. The two conflicting objectives are the probability of false alarm rate and probability of detection. To provide good classification results, the multi-objective cuckoo search algorithm is designed to optimise SVM's parameters. In addition, the local search manner is also changed to increase the local search speed. Simulation results show the new algorithm is promising.

Product platform has been recognised as an effective means to achieve mass customisation. A key feature affecting the success of a product family is the effectiveness of the product platform across diverse market segments. Adaptable design is a design methodology to create designs and products that can be adapted readily to meet different requirements. The product platform with adaptability provides the basis for the modification, evolvement and upgrading of product family. In the paper, 'Measurement method and application of design adaptability for product platform based on information content', X. Cheng et al. focus on the design adaptability issue of product platform, i.e., the evaluation of the cost effectiveness of a product design that can be adapted to meet individual customer's needs. Four aspects of adaptability are considered, including reusability, customisability, interface flexibility and upgradeability. Product platform adaptability is measured based on the information content metric. Finally, a case study is given to prove the effectiveness and feasibility of the proposed method.

Firefly algorithm (FA) is a new optimisation technique based on swarm intelligence, which has been applied to various optimisation areas successfully. In this paper, 'Firefly algorithm for multi-objective optimal allocation of water resource', W. Wang et al. propose a new FA variant to solve multi-objective optimal allocation of water resource, where three objectives, including economic, social, and environmental benefits, are maximised. To obtain the Pareto fronts, the original FA is combined with the fast non-dominated sorting method used in NSGA-II. Simulation results show that the newly developed approach can achieve a good spacing of solution points along the Pareto front. According to the preferences, the decision makers can choose different allocation methods from the Pareto front.

In the paper, 'Multi-level assembly process complexity analysis and its application for mixed-model assembly sequencing', F. He and M-m. Jiang aim to understand the process complexity for the production activities and their sequences in assembly systems. Four primary integer layers and other fractal layers are decomposed from the whole assembly process according to the fractal theory. Four kinds of complexities, station operation complexity, assembly flow complexity, production sequence complexity and production cycle complexity, are proposed to capture the complexity characteristics for different integer layers. The information entropy is adopted to measure these process complexities. Two different measurements are suggested for the pull and push production models, respectively. The optimisation objective is to minimise the diversity of the assembly flow complexity to trade-off the two contradictory problems of high operation failure rate and decrease of the working emotion, which are caused by inappropriate product similarity distribution. The multi-objective genetic algorithm is adopted to modelling the mixed-model assembly sequencing problem with two optimisation objectives and a case study is implemented to demonstrate the approach.

In this paper, 'Hardware implementation of multi-objective differential evolution algorithm: a case study of spectrum allocation in cognitive radio networks', K.K. Anumandla et al. present a hardware solution for multi-objective differential evolution (MODE) algorithm. The hardware is used to solve multi-objective optimisation problem and a set of Pareto optimal solutions are obtained. The proposed hardware is developed as a co-processor and interfaced with PowerPC440 processor of Virtex-5 field programmable gate array to accelerate the execution speed of the MODE algorithm on an embedded platform. The functionality of the MODE core is validated by optimising two standard benchmark functions. Then, the execution time of the MODE core is compared with the execution time of the same algorithm on a 32-bit RISC PowerPC440 processor of Virtex-5 FPGA. As a case study, the proposed hardware is used to solve spectrum allocation (SA) problem in cognitive radio networks. In cognitive radio network, the available licensed channels are assigned to cognitive users using SA task by satisfying the multiple objectives to provide best channels without the interference to primary users. The MODE core is integrated with the SA objective functions and developed as a MODE-based SA

(MODE-SA) co-processor on an embedded platform for distributed cognitive radio network. The MODE-SA core has attained a speedup of 50-60x compared to the PowerPC440 processor to complete the allocation process.

This special issue on 'recent advances on EMO' presents the latest research and developments in EMO. The guest editors expect that the readers will benefit from the papers presented in this special issue.

The guest editors of this special issue would like to thank all authors for submitting their interesting works to this special issue. We would like to express our sincere appreciation to the Editor-in-Chief, Dr. Nadia Nedjah, for his advice and support. Xiao-Zhi Gao's work is a part of the DIGI-USER research platform of Lappeenranta University of Technology, Finland.