Editorial

Ruili Wang*

School of Engineering and Advanced Technology,
College of Sciences, Massey University,
Private Bag 11 222,
Palmerston North, New Zealand
E-mail: r.wang@massey.ac.nz
*Corresponding author

H.J. Ruskin

School of Computing,
Dublin City University,
Dublin 9, Ireland
E-mail: hruskin@computing.dcu.ie

Biographical notes: Ruili Wang received a PhD in Computer Science from Dublin City University and is currently a Senior Lecturer in Computer Science at Massey University, New Zealand. His research interests include modelling complex systems and the applications of artificial intelligence. He is an Associate Editor and Member of the Editorial Boards of *The IEEE Intelligent Informatics Bulletin, International Journal of Intelligent Systems Technologies and Applications, International Journal of Modelling Identification and Control* and *International Journal of Business Intelligence and Data Mining*. He is currently supervising five PhD students and holding several research grants.

H.J. Ruskin received a PhD in Statistical and Computational Physics from Trinity College, Dublin. She is a Professor in Computing and Associate Dean of Research, Faculty Engineering and Computing at Dublin City University, Dublin, Ireland. She chairs the Modelling and Scientific Computing Research Group. She has supervised over 30 postgraduate research students and routinely manages postdoctoral and research development staff. Her research funding includes both national and international awards. Research interests include (i) statistical and computational models of spatiotemporal processes in bio-systems/socioeconomic systems (ii) applications in natural/medical sciences.

The investigation of complex systems is typically not amenable to exact solutions. Consequently, a body of approximate techniques, mathematical, statistical and computational, are used to provide insights on the evolutionary behaviour and characteristics of systems, comprising many bodies, multiple interactions on a number of levels and similarly, described by large and/or inter-dependent parameter sets. Examples and occurrence of complexity in both natural and artificial systems are wide-ranging. The emphasis in this special issue is on publishing papers that demonstrate original and non-trivial work, which spans this range.

This special issue thus gathers research efforts from applications as diverse as biology, financial planning, economic or social infrastructure, GIS, and also includes aspects of the theory and methods underpinning investigation of complex systems. The first five papers deal with Multiagent Systems (MAS) and serve to demonstrate this diversity. Jiu and Hu discuss modelling complex or emergent behaviour, with particular focus on the local-global relationship in a Self-Organising Multi agent System (SOMAS). A subsequent paper, Cannata et al. applies the multiagent paradigm to modelling cell components involved in the metabolic pathways of carbohydrate oxidation. The use of biological deployment on an individual but cooperative unit scale is demonstrated by Feltell and coworkers, who present a 3D agent-based simulation model of emergent behaviour of Macrotermes termites, focusing on construction of the queen's royal chamber and protective trail galleries using available biological evidence. The multiagent cooperative paradigm is also applied in financial investment planning by Zhang and co-authors, who develop a system in which all agents work together to provide reasonable investment advice. Further, Jaff et al. investigate emergence, in terms of automatic computation of such systems, based on a population of automata. The authors have developed a powerful algebraic structure to represent behaviours concerned with cooperative and competitive multiagent processes.

A further set of six papers span a wide range of techniques and several different disciplinary applications. For a Geographical Data Base (GDB), Kadri-Dahmani et al. describe a consistent updating process, for which a complex flux over a GIS can lead to an emergent property that permits global consistency to be maintained over the

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whole GDB from local maintenance considerations only. Panzieri and Setola analyse performance degradation in infrastructure systems, induced by the presence and spread of failures, in order to investigate key critical links between different events, based on the Input–Output Inoperability model. The authors also use Fuzzy Numbers (FNs) to describe different quantities in relation to data ambiguity and to facilitate interaction between operators and stakeholders. A random network model is proposed by Guo and co-authors, where complex behaviour is conditioned by constraints on the average distance and average degree of connectivity remaining approximately constant. A further application to biodiversity is presented by Idels and Wang, who describe a canonical differential equation model for fish population densities. Their study indicates that a control parameter β (relating fish population size to the fishing effort function E), changes not only the rate at which the population reaches equilibrium, but also the equilibrium value attained. Additionally, Lee et al. investigate the effect of individual and interactive rules from the perspective of observational emergence of a fuzzy logic controller, evolved from a genetic algorithm. The nature of cooperative complementarity is also examined by Lo Storto and coworkers, who present a method to analyse performance of the product development model adopted by an organisation. These authors investigate the nature of information exchanged and the knowledge flows in task coordination. In particular, the effect of ambiguity in these exchanges and flows is considered.

Finally, we would like to thank both the authors, who contributed to this special issue, for their timely submission and revision, and the anonymous reviewers, for their critical suggestions for improvement of these papers. Support of the staff in Inderscience is also warmly acknowledged.

Last but not least, our sincere thanks go to Editor-in-Chief, Professor Quan Min Zhu, for his support of the topic area and for his guidance in relation to this special issue.