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## Preface

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**Biographical notes:** Petia Koprinkova-Hristova received her MSc in Biotechnics from the Technical University – Sofia in 1989 and PhD in Process Automation from Bulgarian Academy of Sciences in 2001. Since 2003, she has been an Associate Professor in the Institute of Control and System Research and in the Institute of Information and Communication Technologies, Bulgarian Academy of Sciences in 2012. Her main research interests are in the field of intelligent control systems using mainly fuzzy, neuro-fuzzy and neural network approaches. Currently, she is a member of European Neural Network Society (ENNS) executive committee in 2011–2016 and a member of the Union of Automatics and Informatics in Bulgaria.

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Tulay Yildirim received her BSc (1990), MSc (1992) in Electronics and Communication Engineering from Yildiz Technical University (YTU), Istanbul, Turkey, and PhD (1997) in Electrical and Electronics Engineering from University of Liverpool, UK. Currently, she is working as a Professor in YTU. She is the Director of Machine Intelligence and Electronic Design Automation Lab (MEDALab). She is one of the founders of INISTA-International Symposium on Innovations in Intelligent Systems and Applications. Her research interests are intelligent systems, analogue and digital integrated circuit design, biometrics, artificial neural networks and biomedical electronics.

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This special issue contains extended versions of the best papers selected among the presentations in the 2013 IEEE International Symposium on Innovations in Intelligent Systems and Applications (IEEE INISTA 2013) that was held from 19th to 21st of June 2013 in, Bulgaria. The symposium was initiated in 2005 by the Yildiz Technical University in Istanbul. Then it became a traditional annual meeting that brings together the researchers from the entire spectrum of the multi-disciplinary fields of intelligent systems and establish effective means of communication between them. In 2013, the symposium was organised for

the first time outside Turkey in cooperation with the Institute of Information and Communication Technologies, Bulgarian Academy of Sciences.

It already became a tradition to publish a special issue of *International Journal of Reasoning-based Intelligent Systems* with best papers from INISTA. Accepted this year works cover wide range of intelligent methodologies – varying from neural networks through fuzzy logic, their combination, heuristic and gradient optimisation algorithms – as well as applications in various areas – classification of images, EEG and ECG signals,

target tracing, optimal process control and synthesis of mechanisms.

The first paper is devoted to investigation of improvement of classification accuracy of the concept learning task using PCA preprocessing of the data as well as to assessment of the 'concept complexity' based on achieved improvement.

The second paper is purely theoretical. It proposes a new mathematical model of neural networks using index matrices.

The next two papers present applications of heuristic optimisation algorithms (modified ABC, GA, PSO and ACO) for solving of two practical problems – heart beat classification using ECG signals and synthesis of optimal four-bar plane mechanisms.

Classification via fuzzy-C-means technique of EEG signals aimed at assessment of human emotional state was presented in the fifth paper.

Next fuzzy T-Conorms/T-Norms were compared with recently developed Dezert-Smarandache Theory on the task of target tracing.

The last paper presents application of iterative Newton-Raphson and Levenberg-Marquardt algorithms for solving of on-line optimisation task using predictive control approach and Takagi-Sugeno fuzzy-neural network as a model of the continuous stirred tank reactor.

We hope that the issue will attract the interest of broad auditory varying from scientists working in intelligent systems theory to all practitioners interested in real world applications of such systems.