PREFACE

The first five papers in this special issue cover the main themes presented during the plenary lectures at the *International Conference for Young Researchers in Computer Science, Control, Electrical Engineering and Telecommunications (ICYR 2006)*. This conference was a forum for young scientists to present their research results and also to attend plenary lectures designed to cover a range of key currently active research areas in control, systems engineering, computer science, electrical engineering and telecommunications, to learn about the most important and hot topics in the area.

The second set of papers in this issue are expanded versions of the best six presentations of young scientists attending the conference. The paper by E. Zerz gives a survey of some of the key areas and open questions in the behavioral approach to systems theory for standard and multidimensional systems theory. In his paper, P. H. Bauer deals with the intersection between control systems and telecommunications by giving an overview of problems which arise when a control system is applied in a networked environment, with particular emphasis on the problem of synchronization, supported by examples from congestion control, sensor networks, vehicle networks and swarms. Iterative learning control (ILC) is a technique for controlling systems operating in a repetitive (or pass-to-pass) mode with the requirement that a reference trajectory defined over a finite interval be followed to a high precision. Examples of such systems include robotic manipulators that are required to repeat a given task, chemical batch processes or, more generally, the class of tracking systems. D. H. Owens S. Daley give an overview of some recent results and open problems in this area, which also forms an application area for, in particular, 2D systems theory and control law design. The paper by R. Rabenstein and S. Petrausch again deals with a subject which is at the intersection of, in particular, mathematical modeling, systems theory and acoustics. This paper focuses on block-based physical modeling, which is a methodology for modeling physical systems with different subsystems and exposes links to the wave digital principle. An example in musical acoustics shows how this approach can be applied. The last paper from the plenary lectures is authored by T. Zięba and D. Uciński and deals with the problem of optimal path planning for a sensor network with multiple mobile nodes, whose measurements are to be primarily used to estimate unknown parameters of a system modeled by a set of partial differential equations. Central to the approach is the parameterization of the sensor trajectories based on cubic B-splines.

The first of the contributed papers, by M. Hunger and D. Marienfeld, develops a self-checking Booth-3 multiplier and a new self-checking Booth-2 multiplier by the use of parity prediction. This combines the error-detection capabilities of Booth-3 (or Booth-2) decoder cells and parity prediction. Additionally, code-disjointness is ensured and combined with partial product generation. The paper by S. Yarmolik deals with RAM testing processes and concentrates on pattern sensitive faults, which are most difficult to detect. One of the techniques which can be effectively used to detect this type of fault is the so-called multi-background test technique. This paper defines requirements which have to be taken into account in such an approach and addresses the sequence selection process. The paper by M. Sawerwain and R. Gielerak is in the area of quantum computing. Here the notion of quantum labelled transition systems with predicates is introduced and some of their elementary properties are described. In particular, the notions of the most general quantum predicates based on the concept of positive operator-valued measures are proposed and their relevance for the quantum algorithms synthesis is demonstrated. The paper by P. Molchanov and A. Totsky presents the general area of telecommunications and develops a new noise immunity encoding/decoding technique by using the features of triple correlation and bispectrum, widely employed in digital signal processing systems, operating in a noisy environment. Errorless decoding probability is analyzed by means of computer simulation for the transmission and reception of

a test message in a radio channel disturbed by both additive white Gaussian noise (AWGN) and a mixture of AWGN and impulsive noise. In the paper by K. Halawa, a new method for learning a Fourier series neural network via a multidimensional discrete Fourier transform is developed. The major advantage of this is the low computational complexity. This method is used next for modelling dynamic systems. The final paper, by Ł. Hładowski *et al.*, reports recent progress on the development of a SCILAB compatible software package for the analysis and control of linear repetitive processes, which are a class of multidimensional systems with practical and algorithmic applications.

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