Summaries

AUTOMATICS – THEORY

Elżbieta Żołopa, Piotr Grabowski: **Dynamical Model of Propagation of Pollutants in a River** • Automatyka 2008, t. 12, z. 2

In this paper a dynamical model of propagation of pollutants in a river with M point controls in the form of aerators and K point measurements is being transformed to an abstract model on a suitably chosen Hilbert space. Our model belongs to the class of abstract models of the factor-type. It is shown that the semigroup generated by the state operator A has a property of decaying in a finite-time, the observation operator is admissible, and the system transfer function is in the space H^{∞} ($\mathbb{C}^{+}$, L($\mathbb{C}^{M}$, $\mathbb{C}^{K}$)). In the final part we also formulate the LQ problem with infinite-time horizon.

Keywords: *control of infinite-dimensional systems, semigroups, water-quality control*

Jerzy Baranowski: **Output Collocation Method for Continuous State Estimation from Discrete Output Measurements in Linear Dynamical Systems** • Automatyka 2008, t. 12, z. 2

The goal of this paper is to introduce a new method for dynamical system output approximation – output collocations. The need for such approximation arises when the measurements are discrete in time and we want to estimate the continuous state of the system. Such approximation can be used along with a continuous asymptotic observer as part of a solution for continuous state estimation from discrete output measurements (CSEDOM) problem. The presented method is designed specially for this task and, besides output measurements, it uses the CSEDOM information from earlier iterations. This method is also presented along with classical interpolation approach which was considered in the author's previous works.

Keywords: *CSEDOM, output collocations, state estimation, polynomial approximation*

Michał Ganobis: **On a Control of Variable Moment of Inertia System "Ball on Beam"** • Automatyka 2008, t. 12, z. 2

The purpose of this paper is to present a "ball on beam" system and a short overview of possibilities of its control. It contains con-

trol design methods using mathematical model (LQR), and without it (fuzzy logic controller).

Keywords: *ball, beam, optimal control, fuzzy control*

Andrzej Tutaj: **An Adaptive Smith Controller Suitable for Usage in Distributed Control Systems** • Automatyka 2008, t. 12, z. 2

The paper describes an adaptive control system for a linear finite-dimensional and asymptotically stable SISO plant with a slowly changing delay time at the input or output. The estimate of a dead time obtained by a continuous identification is used in a delay line, which is a part of a Smith predictor. Use of the adaptation enlarges the stability region and increases the performance of a system. The described setup can be used for distributed control systems where delays are introduced by the communication network. This approach succeeds if delays in the network vary slowly with time.

Keywords: *Smith predictor, time-delay systems, adaptive control, distributed control systems*

AUTOMATICS – APPLICATIONS

Adam Piłat, Paweł Piątek: **Carry out the FPGA Technology in AGH Department of Automatics in Research on MagLev Control Purposes** • Automatyka 2008, t. 12, z. 2

The Active Magnetic Levitation systems (MagLev) represents the programmable dynamics devices. The application of FPGA technology to measurement and control tasks allowed to develop individual hardware-software solutions that increases quality and performance of the control system. Nowadays these tools ale also used for control purposes. The increasing FPGA capacity, shows that it will be possible to realize dedicated and programmable hardware controllers. Current research is oriented to methods and tools that will allow too implement in FPGA complex control algorithms.

Keywords: *FPGA, magnetic devitation, Active Magnetic Bearings, real-time control, I/O boards*

Mariusz Kalita, Waldemar Wójcik: **Adaptive Controll of Combustion Process** • Automatyka 2008, t. 12, z. 2

The paper presents simulation of applying evolutionary algorithms and neural networks in power boiler process regulation.

The various methods of selection, niche mechanism and coupling methods are presented in the paper. The results show that implementing proper selection operator and niche mechanism allow to prevent premature convergence and reduce computation time.

Keywords: *evolutionary algorithms, neural networks, combustion process*

Dariusz Marchewka, Marcin Piątek: **Embedded Systems as a Mobile Robot Controllers** • Automatyka 2008, t. 12, z. 2

The paper presents the idea of the embedded system for a mobile robot control purposes. Some foundations were disccused. The first part of the paper describes the hardware elements of the system and names its advantages and disadvantages. The second part is focused on the software and especially on the Open Source, GPL licensed GNU/Linux operating system. In the summary the embedded system with GNU/Linux is suggested as mobile robot control platform.

Keywords: *autonomous mobile robots, embedded system, GNU/Linux*

Konrad Kułakowski, Marek Kostrzewa: **Real Time Systems Modelling in UML** • Automatyka 2008, t. 12, z. 2

Most of the early real time systems have been implemented entirely in hardware. Gradually real time systems have becoming mixed software-hardware solutions. At present, software has a dominant position and frequently decides about almost the whole functionality of the given system. Growing importance of software in real time systems makes room for software engineering techniques supporting theirs development. In this paper authors try to go quickly through software supporting development of real time reactive systems. A special attention is drawn to the object oriented tools and methods. On the background of the other solutions the home grown utility package RAT (Reactive Appliance Toolkit) is presented.

Keywords: *MDA, UML, Real Time Systems, RAT*

Adam Kurnicki, Waldemar Wójcik: **Diagnosis of Paper Machine Actuators Using Artificial Intelligence Methods** • Automatyka 2008, t. 12, z. 2

This work is intended to give a view on the designing issue of fault detection and isolation system for paper machine actuators.

Article presents some fault detection and isolation algorithms. The proposed algorithms use artificial intelligence methods (fuzzy logic supplemented with artificial neural network) for nonlinear process modeling and multi-value residuum change detection.

Keywords: *fault detection and isolation, neuro-fuzzy systems, paper machine*

Waldemar Wójcik, Konrad Gromaszek: **The Use of Data Mining Approach to Prediction Control Strategies for Industrial Processes** • Automatyka 2008, t. 12, z. 2

This work is intended to give a view on alternative application of data mining techniques. Paper shortly presents business intelligence (BI) solution based on SQL Server 2005 and some data mining tasks and techniques are discussed. The next part of the work focuses on prediction example using Microsoft Decision Trees. The use of discussed techniques for industrial process advisory system is also considered.

Keywords: *data mining, prediction, control*

Marta Kraszewska: **Multi-Level System of Production Planning in Selected Company** • Automatyka 2008, t. 12, z. 2

The article presents the essence of multi-level system of production planning. The type of plans prepared in companies and the course of production planning are discussed in detail. Theoretical considerations were supported the discussion of the real multi-level system of production planning in one of the companies from car industry.

Keywords: *production planning, multi-level system of production planning*

COMPUTER SCIENCE – THEORY

Wojciech Mitkowski: **Possibilities and Limitations of Computer Science** • Automatyka 2008, t. 12, z. 2

In the paper possibilities and limitations of applied computer science are considered. An attention is drawn to cognitive limitations. On the other hand analysis of computer simulations develops our imagination and makes it easier to formulate research hypothesis.

Keywords: *computer sciences, iterative function, fractal space, chaotic dynamics, linear equation*

Leszek Kotulski: **Parallel Allocation of the Distributed Software Using Node Label Controlled Graph Grammars** • Automatyka 2008, t. 12, z. 2

Centralization of a graph's data is useful while we consider properties of some system specification but it seems to be not acceptable in the case of the support an efficient, high reliably system with a dynamic software allocation. In the paper, we introduce the aedNLC graph grammar, that has both polynomial computational complexity and enough descriptive power to coordinate parallel modification of a few local graphs (representing parts of the system), in such a way that the global consistency of the distributed system specification can be maintained.

Keywords: *graph transformation, distributed computing, allocation control*

Paweł Mitkowski: **Remarks about Lasota–Ważewska Equation** • Automatyka 2008, t. 12, z. 2

The work concernes mathematical model of arising of red blood cells called Lasota–Ważewska model. Using Matlab Simulink Lasota–Ważewska simplified equation was modelled. Many simulations were done and their biological interpretations were given.

Keywords: *application of mathematics, differential equations, dynamics of biological systems*

Mirosław Kasper: **Middleware Based Replication for Database Systems** • Automatyka 2008, t. 12, z. 2

Researches in database replication field, which have been made in recent years, allowed to design and implement many approaches for database replication. The most important features of proposed solutions are improved scalability and system's fault tolerance, and as a result of both of them increased overall performance and availability of the replication systems. Majority of recent approaches for transactional data replication are based on multilayer architectures with middleware tier between client and database tier. In this article there is a presentation of solutions used for realization of middleware-based database replication.

Keywords: *data replication, distributed systems, databases, replication architectures*

Konrad Płachecki, Sławomir Przyłucki: **Analysis of Efficiency on Congestion Control Mechanisms in Early Detect Congestion Algorithms in TCP/IP Networks** • Automatyka 2008, t. 12, z. 2

This paper presents active queue management mechanisms to provide congestion control in TCP/IP best-effort networks: RED, REM and FuzzyREM (FREM). Authors propose, how to better solve the drop tail and buffer utilization problems in the basic AQM mechanisms, with one buffer and a server.

Keywords: *AQM, FREM, TCP/IP*

Ryszard Tadeusiewicz, Marek R. Ogiela: **Novel Element in the Computational Intelligence Toolbox – Automatic Understanding of the Images** • Automatyka 2008, t. 12, z. 2

Computational Intelligence (CI) technology develops over half of century yet. Therefore remaining the frontier of the computer science it become now a kind of maturity together with a kind of saturation. Last years we can observe decreasing progress in theoretical achievements of computational intelligence as well as decreasing level of originality of new practical applications of CI. Taking into account past achievements of artificial intelligence (former name of CI) and taking into account still huge needs for intelligent solutions in all information systems, we must find and develop new paradigms and new tools for computational intelligence. One of such tools should be automatic understanding of the images. In the paper we try explain, why automatic understanding is necessary and we try describe contemporary achievements in automatic understanding of the images area. The main idea of this paper is generalization of our previous results and planning of the future works in the automatic understanding area.

Keywords: *computer vision, image processing, cognitive science, image understending computational intelligence*

COMPUTER SCIENCE – APPLICATIONS

Paweł Wróblewski, Krzysztof Boryczko: **Parallel Implementation, Applications and Results of the SPH Method in Simulations of Incompressible Fluid Flows** • Automatyka 2008, t. 12, z. 2

The SPH method for simulating incompressible fluids is presented in the article. The background and principles of the SPH

method are explained and its application to incompressible fluids simulations is discussed. Next, two methods of neighbor search for the SPH algorithm based on a constant number of neighbors and a constant cut-off radius are presented. Firts, feasible methods of comparison are naalyzed. Then the methods are compared visually and computationally. The obtained results suggest that the method with a constant cut-off radius is better than that with a constant number of neighbors. Subsequently, adaptations of the SPH method for simulating incompressible fluids which focus on surface tension are presented. The modification for surface tension simulation, which relies on incorporating additional forces into the model, as well as the methodology are suggested. The results obtained with the method are presented and discussed. Finally, the parallel implementation of the SPH simulation with OpenMP environment is demonstrated and analyzed.

Keywords: *computational fluid dynamics, particle methods, SPH, parallel computing, OpenMP*

Łukasz Mazur: **Constraint Programming with ILOG OPL Studio** • Automatyka 2008, t. 12, z. 2

The review of constraint programming method in ILOG OPL environment was presented in this article. Possibilities of this method as well as strong support for it from the ILOG Solver, they became concisely here described. The describes methodologies of constraint programming are very useful to the solving of hard combinatorical, decision and optimization problems.

Keywords: *CP/CLP, constraints, combinatorial problems, constraint satisfaction problem CSP, constraints programming, ILOG OPL environment*

Krzysztof Dorosz: **Extraction of Coherent Text from the Internet for Use in Natural Language Processing** • Automatyka 2008, t. 12, z. 2

Computer Linguistic is aimed to develop and improve text information extraction methods. Internet become very extensive source of text, yet it is overloaded by thematically incoherent texts grouped by one presentation context (e.g. WWW page). This fact determines difficulties with usage of such texts as text corpuses for NLP processing (especially statistics based algorithms). Presented

work is aimed to develop methods of extraction coherent texts from Web pages, that can improve quality of information extraction.

Keywords: *text extraction, Internet, text, DOM, HTML*

Maciej Laskowski: **Usability Analysis of the Most Popular Implementations of CAPTCHA Tests** • Automatyka 2008, t. 12, z. 2

Due to rapid development of Internet, Web 2.0 in particular, websites need to be protected from automated (and undesired) usage of offered services (eg. mass creating of email accounts) or publishing content. Nowadays, majority of websites use CAPTCHA (*Completely Automated Public Turing Test to Tell Computers and Humans Apart*) technology, which was invented in late 90s. This solution is often criticized as 'user unfriendly'. In this article usability of chosen CAPTCHA implementations is tested. Token-generation techniques, their advantages and disadvantages are con-sidered. Alternatives for existing solutions are described.

Keywords: *usability, CAPTCHA, Internet, Turing test, reverse Turing test*

Marcin Ochab: **RTG Images Processing for Better Prediction Efficiency of Infants Bronchopulmonary Dysplasia** • Automatyka 2008, t. 12, z. 2

This paper presents a draft of algorithm extracting numerical parameters from infants X-ray images which would be helpful in prediction lungs disease, especially bronchopulmonary dysplasia. Main emphasis was made on preprocessing phase to limit further analysis area only to interesting organs surface. Furthermore there were considered problems which should be overcome to full automation of analysis process.

Keywords: *RTG images, infants bronchopulmonary displasia*

Tomasz Szymczyk: **The Method of the Template Matching in Image Processing – Limitations, Problems and the Modifications of the Method** • Automatyka 2008, t. 12, z. 2

The method of the template matching has found many applications. It is used successfully in recognition of simple binary contours and also in dynamic recognition of the objects in video sequences. It is still applied and developed despite the simplicity and

numerous deficiencies of the method. In the paper the evolution of recognizing objects based on the model was introduced. The author presents recognition of the pictures in the context of the texture recognizing. Simple transformation resulting in the considerable improvement of the operation of the template matching method was applied. It has been observed that this transformation does not enlarge significantly the time and the cost of the calculations.

Keywords: *image processing, template matching, texture recognition*

Jakub Smołka, Maria Skublewska-Paszkowska: **Removal of the Over-Segmentation in the Results of Watershed Tranformation by Means of Cluster Analysis** • Automatyka 2008, t. 12, z. 2

Watershed transformation can be applied to color as well as to gray-scale images. It requires a height function as its input. Most images may be converted to the required form by means of a gradient filter suited for the type of image being segmented. Unfortunately, in most cases, the image after watershed transformation is heavily over-segmented. Using simple methods for reducing over-segmentation doesn't give good results. This paper presents a solution to this problem that utilizes cluster analysis. It allows for watershed merging that produces a requested number of classes. Cluster analysis is very flexible. Its parameters can easily be exchanged in order to adapt the method for a particular type of image. Attributes used for watershed merging may take into account information that is disregarded by the watershed transformation itself.

Keywords: *image segmentation, watershed transformation, cluster analysis*

Piotr Kopniak: **Steganographic Use of Directional Filter Pyramids** • Automatyka 2008, t. 12, z. 2

Steganography is a branch of knowledge which deals with confidential information security by hiding the secret information inside the public one. A digital recording which assures high quality, better data destruction prevention then an analog recording and an easy computer processing is today a main way of a multimedia data saving. This type of data is utilised by computer steganography because of their high redundancy. The redundant data may be substituted by the secret information. This article contains a description of the new steganography algorithm prepared for the author's PhD

dissertation based on an innovative use of multiresolution image decomposition by directional filters pyramids (steerable pyramid transform). The steerable pyramids have some advantages comparing to e.g. wavelet transform i.e. more directional subbands at each scale level which gives more information hiding opportunities. The article describes the data embedding algorithm based on Lee and Chen statistical method in detail and the results of the research made for the specification of the algorithm parameters and its steganographical accuracy.

Keywords: *information security, steganography, image processing, multiresolution decomposition, steerable pyramids*

Artur Zawadzki: **The Stereovision Algorithm Used to Appointment of Hand Fingers Orientation and Possibility of Its Implementation in the FPGA System** • Automatyka 2008, t. 12, z. 2

In this dissertation was presented suggested by the author algorithm, which is used for appointment of orientation of hand fingers and is based on the stereovision algorithm. Results was presented for the model of hand and for the real hand. Structure of algorithm is well directed on using FPGA systems from the consideration of parallelly occurring operations. On that account it takes attempt of verification efficency of algorithm implementation with use of the Handel-C language in FPGA systems.

Keywords: *stereovision, FPGA, hand arrangment recognition, Shirai algorithm, Hough transform*

Andrzej Kotyra, Waldemar Wójcik: **Combustion Diagnosis of Pulverized Coal Using Image Processing** • Automatyka 2008, t. 12, z. 2

The paper presents characterization of pulverized coal flames with image processing. A laboratory combustion facility has been described as well as methodology of the research. Several shape parameters have been used, such as flame area mass, flame area contour length and coordinates of its gravity center for qualitative describing the flames being considered.

Keywords: *image processing, combustion, pulverized coal*