

Buletinul Institutului Politehnic din Iași
Tome LII (LVI)
Fasc. 1-4, 2006

AUTOMATIC CONTROL and COMPUTER SCIENCE
Section

CONTENTS

M. VOICU, C. LAZĂR, O.PĂSTRĂVANU, T. CANCIU, E. BALABAN, I.BEJAN and D. PĂNESCU, Brief History of the Automatic Control Degree Course at “Gheorghe Asachi” Technical University of Jassy.....	7 - 18
LAVINIA FERARIU and LETIȚIA MIREA, Matlab Toolbox Based on Evolutionary Strategies	19 – 30
LUCIAN MASTACAN, Fuzzy Logic Controllers Design for Fast Dynamic Processes.....	31 – 38
CIPRIAN ANDRICI, CRISTINA HĂLĂUCĂ, CORNELIU LAZĂR and DANIEL PĂTRAȘCU, A Non-Interacting Multivariable Approach to Pressure-Flow Control in Gas Pipelines.....	39 – 46
MIRCEA HULEA, Electronic Model of Neurons for Neural Networks Unsupervised Learning.....	47 – 56
OCTAV BRUDARU and CINTIA COPĂCEANU, Mixed-Model Assembly Line Balancing Problem: A Review.....	57 – 78
PETRU CAȘCAVAL, RADU SILION and ANDREI STAN, MarchS2C: a Test for all Static 2-Cell Ram Coupling Faults.....	79 – 86
VLAD RĂDULESCU and AL. VALACHI, Efficient Minimization Techniques in Hardware Automata Design.....	87 – 96
DRAGOȘ AROTĂRIȚEI and MITICĂ CRAUS, An Evolutionary Algorithm for Multi-Criteria Optimization of District Heating Network.....	97 - 106
MIHAI-HORIA ZAHARIA, FLORIN LEON and FLORIN GRIGORIU, Using Intelligent Agents Framework for Increasing the Mobile Computing Security.....	107 – 114
OCTAV BRUDARU and OCTAVIAN BUZATU, Integrating Fuzzy Arithmetic in Kohonen Networks.....	115 – 126
CRISTIAN MIHAI AMARANDEI, ALEXANDRU ARCHIP and SIMONA ARUȘTEI, Performance Study for MySQL Database Access Within Parallel Applications.....	127 – 134
PETRUT DUMA, Logic Analyser with Analog to Digital Conversion of Signals from Development Systems Equipped with At89c51 Family Microcontroller.....	135 - 143

BRIEF HISTORY OF THE AUTOMATIC CONTROL DEGREE COURSE AT "GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF JASSY

by

**Mihail Voicu, Corneliu Lazăr, Octavian Păstrăvanu, Teohari Ganciu, Eugen
Balaban, Ioan Bejan and Doru Pănescu**

The Faculty of Automatic Control and Computer Science within "Gheorghe Asachi" Technical University of Jassy, one of the leading training and research centre in the field of automatic control and computer science from Romania, has celebrated in the University year 2002-2003 40 years from the appearance of the first courses in the above mentioned field and 25 years from the emergence of the Automatic Control and Computer Science degree course. On that occasion and afterwards, some of the most significant scientific achievements have been put together in this paper, as a brief history of the development of education and research in automatic control at the "Gheorghe Asachi" Technical University of Jassy.

Keywords: Higher Education in Control Engineering, Automation in Developing Countries, University - Industry Liaison, East - West Collaborative Programs.

MATLAB TOOLBOX BASED ON EVOLUTIONARY STRATEGIES

by

Lavinia Ferariu and Letiția Mirea

The paper presents a novel MATLAB toolbox, called STRATEV, useful for solving complex nonlinear optimization problems. It implements a methodology based on evolutionary strategies. STRATEV permits a flexible configuration of the evolutionary operators. It includes Gaussian mutation, with and without rotation and it offers facilities for the adaptation of the standard deviations and rotation angles. For a convenient execution over a limited number of generations and individuals, a control of the stochastic number generator state is provided. The toolbox also permits the use of discrete or intermediary crossover. The efficiency of STRATEV is verified on an optimization benchmark recommended in the related literature and with respect to the evolutionary training of a multilayer perceptron neural network.

Keywords: Optimization Problems, Evolutionary Algorithms, Evolutionary Strategies.

FUZZY LOGIC CONTROLLERS DESIGN FOR FAST DYNAMIC PROCESSES

by
Lucian Mastacan

There are two ways to design fuzzy logic controllers, by using mathematical models or linguistic models containing the experience of operators working with the processes. In the second case the information about structure and parameters of the fuzzy logic controller comes from two sources; the experience of the process engineers allows finding the controller structure and the rule base, and during starting-up one gets the adequate parameters of the controller. The necessary tuning rules of the fuzzy logic controllers are generalized knowledge about the behaviour of different types of processes. Tuning algorithms and tuning rules are results of profound understanding and generalization of system behaviour. The above problems are exemplified to design Mamdani type fuzzy logic controllers for fast dynamic processes. A DC servomotor drives speed control is presented. Tuning the parameters of the fuzzy logic controller, good performance bounds for DC servomotor drives speed control are obtained. The experimental results are illustrative.

Keywords: Fuzzy Logic Controller, Look-up Table, DC Motor, Speed Control.

A NON-INTERACTING MULTIVARIABLE APPROACH TO PRESSURE-FLOW CONTROL IN GAS PIPELINES

by
Ciprian Andrici, Cristina Hălăucă, Corneliu Lazăr and Daniel Pătrașcu

Applications that require imposed working values for gas pressure and flow are often meet in industry. In this paper a non-interacting multivariable control strategy for a gas pressure-flow control plant is proposed. An input-output model of a pipeline being in use at a power plant, dedicated to ensure proper gas feeding at a steam boiler, is obtained. Based on this model, the proposed strategy is tested, and simulation results are given.

Keywords: Non-Interacting, Multivariable Control, Flow-Pressure Gas Control

ELECTRONIC MODEL OF NEURONS FOR NEURAL NETWORKS UNSUPERVISED LEARNING

by
Mircea Hulea

This paper presents two models of biologically inspired neurons - one for excitatory and the other for inhibitory neurons. Being able to generate impulses when physical

medium properties change, and to strengthen their synapses when concurrent events happen, these neurons could develop their own synaptic configuration in an unsupervised way. If the unused neurons are removed after network training under task specific stimulation, it is obtained the network topology for that task. Also, this paper presents the experimental results for a network synaptic configuration evolution when a supervisor changes normal operation of the network.

Keywords: Analog Mode, Unsupervised Learning, Modelling, Biologically Inspired, Artificial Networks

MIXED-MODEL ASSEMBLY LINE BALANCING PROBLEM: A REVIEW

by

Octav Brudaru and Cintia Copaceanu

The paper presents a survey of the literature on mixed-model assembly line balancing. Several existing approaches for modelling and solving different types of mixed-model assembly line balancing problems are reviewed considering the layout possibilities: serial lines, U-shaped lines and lines with parallel workstations. The main purpose of the study is to determine new opportunities of applications and a generalization of the solving instruments.

Keywords: Assembly Line Balancing, Mixed-Model Production, Heuristic Methods, Literature Survey.

MARCHS2C: A TEST FOR ALL STATIC 2-CELL RAM COUPLING FAULTS

by

Petru Caşcaval, Radu Silion and Andrei Stan

A fault primitive based analysis of all static simple (*i.e.* not linked) 2-coupling faults in $n \times 1$ random-access memories (RAMs) is discussed. All realistic 2-cell coupling faults that have been shown to exist in real designs are considered, namely: state coupling faults, transition coupling faults, write disturb coupling faults, read destructive coupling faults, deceptive read destructive coupling faults and incorrect read coupling faults. A new memory test, MarchS2C, with $22n$ operations, able to detect all primitive 2-cell coupling faults, is proposed. To compare this test with other industrial march ones, simulation results are also presented in this paper.

Keywords: Memory Testing, Static Fault Models, 2-Cell Coupling Faults, Fault Primitive, March Tests.

EFFICIENT MINIMIZATION TECHNIQUES IN HARDWARE AUTOMATA DESIGN

by
Vlad Rădulescu and Alexandru Valachi

Given the complexity that hardware automata have come to exhibit in today's applications, efficient techniques for making such structures simpler are strongly needed. For simplicity the aim is not only related to the modularity of the design process, but also to the costs of the implementation. The present paper focuses on this second issue, as it suggests a way of reducing the complexity of the boolean expressions describing the state and output variables. Despite the fact that a large number of minimization methods have been proposed, a complete formalization of the process has not been achieved so far. As part of the minimization is still empirical, it is hard to obtain an efficient design of complex automata. This paper extends an alternate representation proposed in [1] and provides a study of the minimization steps that may be applied when using that representation.

Keywords: Analytic Description, Flip-Flop Properties, Minimization Formalism.

AN EVOLUTIONARY ALGORITHM FOR MULTI-CRITERIA OPTIMIZATION OF DISTRICT HEATING NETWORK

by
Dragoş Arotăriţei and Mitică Craus

In this paper we propose an improved solution and a new algorithm for the district heating network design problem, in the case of a new area with potential customers. The problem falls in the *Prize-Collecting Steiner Tree Problem*. The novelty of our approach is that we permit some non-customer vertices (few) to become temporary Steiner nodes in order to improve the quality of the solution. The experimental results showed that the algorithm works well for small and sparse graphs, *i.e.* graphs $G=(V,E)$ which have $|V| = n < 100$ and $|E| = m < n(n - 1)/6$.

Keywords: District Heating Network, Prize-Collecting Steiner Tree Problem, Genetic Algorithms, Multi-Criteria Optimization, Evolutionary Algorithms.

USING INTELLIGENT AGENTS FRAMEWORK FOR INCREASING THE MOBILE COMPUTING SECURITY

by

Mihai Horia Zaharia, Florin Leon and Florin Grigoriu

A new approach for increasing mobile computing security is proposed. Nowadays one of the newest ways of performing computation is represented by framework of agents. The wireless networks used in mobile computing have increased security risks if we take into account the fact that combination of certificates and AES is rarely used in business. So the framework must have a dedicated intelligent agent that will manage the problem. This approach will provide the advantages of adaptability in real time of the agent. This will be increased because all the frameworks will exchange knowledge about the latest discovered threats. This approach tries to decrease the administration work because the mobile user usually has not a stable position so it is hard to offer remote administration to this kind of users.

Keywords: Intelligent Agent, Mobile Computing, Security

INTEGRATING FUZZY ARITHMETIC IN KOHONEN NETWORKS

by

Octav Brudaru and Octavian Buzatu

This paper proposes a hybrid technique for producing crisp clustering of fuzzy data. This technique is a combination between Kohonen networks and arithmetic of -sampled fuzzy numbers. It is investigated an appropriate way for training a Kohonen network working in fuzzy arithmetic. Using two-dimensional fuzzy data this network can act as a piecewise constant fuzzy dependency approximator. The performance of the clustering technique and fuzzy approximator is experimentally analysed.

Keywords: Fuzzy Arithmetic, Kohonen Networks, Clustering Fuzzy Data, Fuzzy Approximator.

PERFORMANCE STUDY FOR MySQL DATABASE ACCESS WITHIN PARALLEL APPLICATIONS

by

Cristian Mihai Amarandei, Alexandru Archip and Simona Aruștei

The results of a performance study of MySQL database access within parallel applications using MPI and C++ are presented. The purpose of this study is to evaluate the performance of locking and concurrency mechanisms in MySQL, in order to improve the design of parallel applications. Concurrent access on shared

resources is important from both database and parallel application point of view. When designing parallel applications with intensive database access, it must be taken into consideration that database access is a computational stage. Thus, choosing the right database table type proves as a very important step in the design, as database queries should not induce significant delays. The goal of our study is to determine which database table type offered by MySQL (MyISAM or InnoDB) is best suited for parallel applications that intensively use SQL writing queries. Considering the results presented in this paper, we conclude that the database table type should be strictly correlated with the specific requirements of grid services or applications relying on database queries, an important factor being the number of processing nodes that need to perform concurrent writing queries.

Keywords: MySQL, InnoDB, MyISAM, Concurrent Access, Parallel Applications.

LOGIC ANALYSER WITH ANALOGUE TO DIGITAL CONVERSION OF SIGNALS FROM DEVELOPMENT SYSTEMS EQUIPPED WITH AT89C51 FAMILY MICROCONTROLLER

by
Petruț Duma

The paper describes the hardware structure of the interface used by a logic analyser for testing development systems equipped with AT89C51 family microcontroller. The interface is connected to a command and control unit equipped with PCB80C552 microcontroller and to a personal computer. Using this interface, all signals are acquired from the tested development system, converted then from analogue to digital in order to be analysed and assembled by software. The command program performs execution and testing functions for instructions run on a tested system, instruction display functions at instruction cycle, semicycle, state, phase and clock levels, initialization function for the tested microcontroller, as well as other general purpose functions.

Keywords: Logic Analyser, Tested Development System, Analog Multiplexer, Analog to Digital Conversion, AT89C51 Family Microcontroller, External Program Memory Fetch Cycle, External Data Memory Read/Write Cycle, Command Software.