



**Editors: Vladimir Vasek, Yurly S. Shmally, Denis Trcek,  
Nobuhiko P. Kobayashi, Ryszard S. Choras, Zbigniew Klos**



## **Recent Researches in Automatic Control**

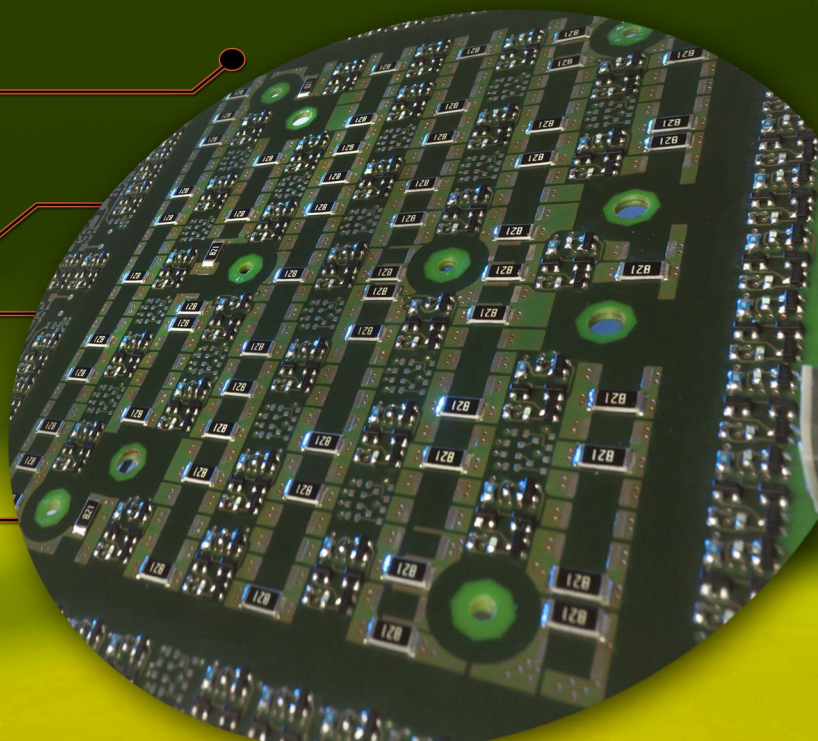
**Recent Researches in Automatic Control**

**13<sup>th</sup> WSEAS International Conference on Automatic Control,  
Modelling & Simulation (ACMOS '11)**

**Lanzarote, Canary Islands, Spain, May 27-29, 2011**



**ISSN: 2223-2907  
ISBN: 978-1-61804-004-6**





# **RECENT RESEARCHES in AUTOMATIC CONTROL**

**13th WSEAS International Conference on AUTOMATIC  
CONTROL, MODELLING & SIMULATION (ACMOS '11)**

**Lanzarote, Canary Islands, Spain  
May 27-29, 2011**

# **RECENT RESEARCHES in AUTOMATIC CONTROL**

**13th WSEAS International Conference on AUTOMATIC  
CONTROL, MODELLING & SIMULATION (ACMOS '11)**

**Lanzarote, Canary Islands, Spain  
May 27-29, 2011**

Published by WSEAS Press  
[www.wseas.org](http://www.wseas.org)

**Copyright © 2011, by WSEAS Press**

All the copyright of the present book belongs to the World Scientific and Engineering Academy and Society Press. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Editor of World Scientific and Engineering Academy and Society Press.

All papers of the present volume were peer reviewed by two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.  
See also: <http://www.worldses.org/review/index.html>

ISBN: 978-1-61804-004-6  
ISSN: 2223-2907



World Scientific and Engineering Academy and Society

# **RECENT RESEARCHES in AUTOMATIC CONTROL**

**13th WSEAS International Conference on AUTOMATIC  
CONTROL, MODELLING & SIMULATION (ACMOS '11)**

**Lanzarote, Canary Islands, Spain  
May 27-29, 2011**



**Editors:**

Prof. Vladimir Vasek, Tomas Bata University in Zlin, Czech Republic  
Prof. Yuriy Shmaliy, Guanajuato University, Mexico  
Prof. Denis Trcek, University of Ljubljana, Slovenia  
Prof. Nobuhiko P. Kobayashi, University of California Santa Cruz, USA  
Prof. Ryszard S. Choras, University of Technology & Life Sciences, Poland  
Prof. Zbigniew Klos, Poznan University of Technology, Poland

**International Program Committee Members:**

Elsayed Atlam, JAPAN  
Caner Akuner, TURKEY  
Ognjen Kuljaca, UNITED STATES  
Muhammed A. Ibrahim, IRAQ  
Ismail Temiz, TURKEY  
Bahadtin Ruzgar, TURKEY  
Mawahib Sulieman, UNITED ARAB  
EMIRATES  
Hossein Shayeghi Moghanlou, IRAN  
Abdullah Mamun, SINGAPORE  
Keylan Alimhan, JAPAN  
Luminita Giurgiu, ROMANIA  
Andreas Terzis, GREECE  
Onsen Toygar, TURKEY  
Sina Khorasani, IRAN  
Stefania Popadiuc, ROMANIA  
Refik Samet, TURKEY  
Mehmet Onder Efe, TURKEY  
Francklin Rivas, VENEZUELA  
Addison Rios-Bolivar, VENEZUELA  
Victoria Rodellar, SPAIN  
Mehmet Hakan Karaata, KUWAIT  
Ichirou Takahashi, JAPAN  
Kai Li, CHINA  
Hwang-Cherng Chow, TAIWAN  
Georgi Gluhchev, BULGARIA  
Francesco Muzi, ITALY  
Sajjad Mohsin, PAKISTAN  
Yong Woo Lee, KOREA  
Nasser Shahtahmasebi, IRAN  
Saeed-Reza Sabbagh-Yazdi, IRAN  
Frangiskos Topalis, GREECE  
Boumchedda Khaled, ALGERIA  
Kalle Kantola, FINLAND  
Ismail Musirin, MALAYSIA  
Helen Catherine Leligou, GREECE  
Slobodan Babic, CANADA  
Lambros Ekonomou, GREECE  
Nam Tran, AUSTRALIA  
Dorin Cismasiu, ROMANIA  
Pooia Lalbakhsh, IRAN  
Shabiul Islam, MALAYSIA  
Florin Dragan, ROMANIA  
Pelin Yildiz, TURKEY  
Stelios Zimeras, GREECE  
Rafic Bachnak, UNITED STATES  
Hong-Tzer Yang, TAIWAN  
Norman Mariun, MALAYSIA  
Oscar Camacho, VENEZUELA  
Chang-Biau Yang, TAIWAN  
Sylvia Encheva, NORWAY  
Rafic Bachnak, UNITED STATES  
Samir Nejm, TUNISIA  
Nicolae Popoviciu, ROMANIA  
Yaw-Ling Lin, TAIWAN  
PooGyeon Park, KOREA  
Dana Petcu, ROMANIA  
Yoonsik Choe, KOREA  
Ioan Salomie, ROMANIA  
Abdel-Latif Elshafei, EGYPT  
Baki Koyuncu, TURKEY  
Ouahdi Dris, ALGERIA  
Zakir Husain, IRAN  
Krishna Busawon, UNITED KINGDOM



**Preface**

This year the 13th WSEAS International Conference on AUTOMATIC CONTROL, MODELLING & SIMULATION (ACMOS '11) was held in Lanzarote, Canary Islands, Spain, May 27-29, 2011. The conference provided a platform to discuss circuits and electronics for control, hybrid systems, digital control, intelligent control, man-machine interaction, cybernetics, simulation, optimization problems in control engineering, decision support systems, fault tolerance, virtual reality for automation, microprocessors, control education, signal processing systems for control, unmanned vehicles etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be indexed by ISI. Please, check it: [www.worldses.org/indexes](http://www.worldses.org/indexes) as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors





# Table of Contents

<b><u>Computation of Predictions in Multivariable Predictive Control</u></b>	15
<i>Marek Kubalcik, Vladimir Bobal</i>	
<b><u>Adaptive Variable Structure Control Law for a Variable Speed Wind Turbine</u></b>	21
<i>Oscar Barambones, Jose Maria Gonzalez De Durana, Patxi Alkorta, Jose Antonio Ramos, Manuel De La Sen</i>	
<b><u>Controllability of Nonlinear Systems</u></b>	28
<i>Jerzy Klamka</i>	
<b><u>Easy Communication Approach for Data Exchange in Distributed Simulation Environment</u></b>	34
<i>Artis Aizstrauts, Egils Ginters, Dace Aizstraute</i>	
<b><u>Training Scenario Operations Realization in Virtual Reality Environment</u></b>	39
<i>Arnis Cirulis, Egils Ginters</i>	
<b><u>Nonlinear Adaptive Control of a Chemical Reactor</u></b>	45
<i>Petr Dostal, Frantisek Gazdos, Vladimir Bobal, Monika Bakosova</i>	
<b><u>Adaptive Digital Smith Predictor</u></b>	51
<i>Vladimir Bobal, Petr Chalupa, Petr Dostal, Marek Kubalcik</i>	
<b><u>Polynomial Approach to Robust Control of Unstable Processes with Application to a Magnetic System</u></b>	57
<i>Frantisek Gazdos, Petr Dostal</i>	
<b><u>Situational Awareness Based Flight Control of a Four-Rotor Type UAV</u></b>	63
<i>Igor Astrov, Andrus Pedai</i>	
<b><u>Stochastic Controllability of Nonlinear Systems</u></b>	69
<i>Jerzy Klamka, Elzbieta Ferenstein</i>	
<b><u>Agent-Based TemPerMod Simulator Cell Architecture</u></b>	75
<i>Ieva Lauberte, Egils Ginters</i>	
<b><u>The Nyquist criterion for LTI Time-Delay Systems</u></b>	80
<i>Libor Pekar, Radek Matusu, Petr Dostalek, Jan Dolinay</i>	
<b><u>Analysis of a Simple Quasipolynomial of Degree One</u></b>	86
<i>Libor Pekar, Roman Prokop</i>	
<b><u>Real Experiences of Pilot Operation of the Photovoltaic System</u></b>	92
<i>Hruska Frantisek</i>	

<b><u>Project of Control System of Thermal Comfort</u></b>	96
<i>Hruska Frantisek</i>	
<b><u>Behavioral Modeling in System Engineering</u></b>	100
<i>Radek Silhavy, Petr Silhavy, Zdenka Prokopova</i>	
<b><u>Requirements Gathering Methods in System Engineering</u></b>	106
<i>Radek Silhavy, Petr Silhavy, Zdenka Prokopova</i>	
<b><u>Adaptive Control of Tubular Chemical Reactor</u></b>	111
<i>Jiri Vojtesek, Petr Dostal</i>	
<b><u>The Numerical Simulation of the Rubber Diaphragm Behavior</u></b>	117
<i>Jakub Javorik, Michal Stanek</i>	
<b><u>The Specimen Optimization for the Equibiaxial Test of Elastomers</u></b>	121
<i>Jakub Javorik, David Manas</i>	
<b><u>Comparison of Energy Modeling and Laboratory Tests on Green Roof Potential to Decrease the Cooling Demand for North European Office Buildings</u></b>	125
<i>Hendrik Voll, Teet-Andrus Koiv</i>	
<b><u>Utilization of the EASI Model in the Matters of Critical Infrastructure Protection and its Verification via the OTB SAF Simulation Tool</u></b>	131
<i>Ludek Lukas, Martin Hromada</i>	
<b><u>Modeling of the Microflow Sensor</u></b>	137
<i>Milan Adamek, Miroslav Matysek, Petr Neumann</i>	
<b><u>One of Possible Methods of Control of Multivariable Control Loop</u></b>	140
<i>Pavel Navratil, Libor Pekar</i>	
<b><u>Segmentation of Production and Security Areas with SICK LMS 400</u></b>	145
<i>Pavel Neckar, Milan Adamek, Lubos Necasal</i>	
<b><u>Prediction of Technological Parameters during Polymer Material Grinding</u></b>	148
<i>David Samek, Ondrej Bilek, Jakub Cerny</i>	
<b><u>Comparison of Artificial Neural Networks using Prediction Benchmarking</u></b>	152
<i>David Samek, David Manas</i>	
<b><u>Teaching Platform for Lessons of Embedded Systems Programming</u></b>	158
<i>J. Dolinay, P. Dostalek, V. Vasek, P. Vrba</i>	
<b><u>Tracking and Disturbance Attenuation for Unstable Systems: Algebraic</u></b>	161
<i>Roman Prokop, Natalia Volkova, Zdenka Prokopova</i>	

<a href="#"><u><b>A Novel Principle for Relay-Based Autotuning</b></u></a>	167
<i>Roman Prokop, Jiri Korbel, Ondrej Liska</i>	
<a href="#"><u><b>Modelling of Thermal Stresses in Printed Circuit Boards</b></u></a>	173
<i>Oldrich Suba, Libuse Sykorova, Stepan Sanda, Michal Stanek</i>	
<a href="#"><u><b>Stress - State Modelling of Injection-molded Cylindrical Bosses Reinforced with Short Fibres</b></u></a>	177
<i>Oldrich Suba, Libuse Sykorova, Stepan Sanda, Michal Stanek</i>	
<a href="#"><u><b>Temperature Field Simulation of Polymeric Materials During Laser Machining Using COSMOS /M Software</b></u></a>	180
<i>Libuse Sykorova, Oldrich Suba, Martina Malachova, Jakub Cerny</i>	
<a href="#"><u><b>Counterfeit Electronic Components Detection Possibilities</b></u></a>	185
<i>Petr Neumann, Milan Adamek, Petr Skocik</i>	
<a href="#"><u><b>MIMO Model Predictive Control with Local Linear Models</b></u></a>	189
<i>Jakub Novak, Petr Chalupa, Vladimir Bobal</i>	
<a href="#"><u><b>Modeling of Hydraulic Control Valves</b></u></a>	195
<i>Petr Chalupa, Jakub Novak, Vladimir Bobal</i>	
<a href="#"><u><b>Data Analysis: Tools and Methods</b></u></a>	201
<i>Prokopova Zdenka, Silhavy Petr, Silhavy Radek</i>	
<a href="#"><u><b>Improvised Shelters - Projecting Methodology and Chosen Aspects of Building Materials</b></u></a>	207
<i>Jakub Rak, Lucie Juoikova, Milan Adamek</i>	
<a href="#"><u><b>Optimization of Injection Molding Process by MPX</b></u></a>	212
<i>Michal Stanek, David Manas, Miroslav Manas, Oldrich Suba</i>	
<a href="#"><u><b>Chemical Resistance of Polymers Modified by Beta Radiation</b></u></a>	217
<i>Zdenek Holik, Michal Danek, Miroslav Manas, Jakub Cerny, Martina Malochova</i>	
<a href="#"><u><b>The Influence of Cross-linking Agent on Mechanical Properties of Polyamide Modified by Irradiation Cross-linking</b></u></a>	222
<i>Zdenek Holik, Michal Danek, Miroslav Manas, Jakub Cerny</i>	
<a href="#"><u><b>Diffusion Model of Washing Process</b></u></a>	226
<i>Dagmar Janacova, Hana Charvatova, Karel Kolomaznik, Vladimir Vasek, Pavel Mokrejs, Rudolf Drga</i>	
<a href="#"><u><b>Simulation of Injection Molding Process</b></u></a>	231
<i>Michal Stanek, David Manas, Miroslav Manas, Jakub Javorik</i>	
<a href="#"><u><b>Suggestion of Improvised Shelter Design</b></u></a>	235
<i>Lucie Jurikova, Jakub Rak, Milan Adamek</i>	

<a href="#"><u>ANN Synthesis for an Agglomeration Heating Power Consumption Approximation</u></a>	239
<i>Pavel Varacha, Roman Jasek</i>	
<a href="#"><u>Design of the Multichannel Measurement System for Strain Gauge Sensor Evaluation</u></a>	245
<i>Petr Dostalek, Jan Dolinay, Vladimir Vasek</i>	
<a href="#"><u>There Are More Locally Brunovsky Systems than Constant Ones</u></a>	249
<i>Miguel Carriegos, Montserrat Lopez-Cabeceira</i>	
<a href="#"><u>The Energetic Balance of the Friction Clutches used in Automotive</u></a>	252
<i>Ion Silviu Borozan, Inocentiu Maniu, Veronica Argesanu, Raul Miklos Kulcsar</i>	
<a href="#"><u>USB MIDI Lights Device</u></a>	257
<i>Dalibor Slovak</i>	
<a href="#"><u>Neural Network Classification of Gunshots using Spectral Characteristics</u></a>	262
<i>Milan Navratil, Vojtech Kresalek, Petr Dostalek</i>	
<a href="#"><u>The Mobile Ordering System with the PDA</u></a>	268
<i>M. Matysek, M. Adamek, P. Neumann, T. Matulik</i>	
<a href="#"><u>Computer Modeling of Non-Stationary Conduction of Heat in Two-Layer Plate</u></a>	272
<i>Hana Charvatova, Vladimir Vasek, Pavel Mokrejs, Miloslav Fialka</i>	
<a href="#"><u>Non-Stationary Temperature Field in a Plane Plate for Symmetric and Asymmetric Problem</u></a>	277
<i>Hana Charvatova, Dagmar Janacova, Karel Kolomaznik</i>	
<a href="#"><u>The Application of Concrete Nonlinear Model Exposed to Impact Load</u></a>	283
<i>Petr Hradil, Jiri Kala, Vlastislav Salajka, Petr Vymlatil</i>	
<a href="#"><u>Solving of Non-Stationary Heat Transfer in a Plane Plate</u></a>	287
<i>Dagmar Janacova, Hana Charvatova, Karel Kolomaznik, Vladimir Vasek, Pavel Mokrejs</i>	
<a href="#"><u>Raman Spectroscopy as an Innovative Method for Material Identification</u></a>	292
<i>Hana Vaskova</i>	
<a href="#"><u>Hide Soaking Controlled by Microcontroller with Ethernet Interface</u></a>	296
<i>Petr Dolezel, Vladimir Vasek, Karel Kolomaznik, Dagmar Janacova</i>	
<a href="#"><u>USB MIDI Pulse Width Modulation Software</u></a>	300
<i>Dalibor Slovak</i>	
<a href="#"><u>Management of Protection of Czech Republic Critical Infrastructure Elements</u></a>	306
<i>Ludek Lukas, Martin Hromada</i>	

<a href="#"><u>Uncertainty Modelling in Time-Delay Systems: Parametric vs. Unstructured Approach</u></a>	310
<i>Radek Matusu, Roman Prokop, Libor Pekar</i>	
<a href="#"><u>Fractional Order Calculus in Control Theory</u></a>	314
<i>Radek Matusu</i>	
<a href="#"><u>Municipal Heating Network Simulation Experiments Based on Days with Similar Temperature</u></a>	318
<i>V. Dolinay, L. Vasek</i>	
<a href="#"><u>Simulation Model of Heat Distribution and Consumption in Practical Use</u></a>	321
<i>L. Vasek, V. Dolinay</i>	
<a href="#"><u>Advanced Voltage Controlled Amplifier for Volume Expanders</u></a>	325
<i>Martin Pospisilik, Milan Adamek</i>	
<a href="#"><u>Logarithmic VU Meter Driver</u></a>	331
<i>Martin Pospisilik, Milan Adamek</i>	
<a href="#"><u>Identification of Arrhenius Equation Parameters for Control Purposes</u></a>	337
<i>Lubomir Macku</i>	
<a href="#"><u>Pole Placement Controller with Compensator Adapted to Semi-Batch Reactor Process</u></a>	341
<i>David Novosad, Lubomir Macku</i>	
<a href="#"><u>Identification of Time Series Model of Heat Demand using Mathematica Environment</u></a>	346
<i>Bronislav Chramcov</i>	
<a href="#"><u>Control of the Serial Production System</u></a>	352
<i>Robert Bucki, Bronislav Chramcov</i>	
<a href="#"><u>Raman Spectroscopy of Epoxy Resin Crosslinking</u></a>	357
<i>Hana Vaskova, Vojtech Kresalek</i>	
<a href="#"><u>Infrared Radiation, Sensor, Source and Infrared Camera Measurement</u></a>	362
<i>Rudolf Drga, Dagmar Janacova</i>	
<a href="#"><u>A Real Models Laboratory and an Elevator Model Controlled through Programmable Controller (PLC)</u></a>	365
<i>Tomas Sysala, Ondrej Vrzal</i>	
<a href="#"><u>The Human Body Behavior under Vehicle Vibrations</u></a>	368
<i>Raul Miklos Kulcsar, Veronica Argesanu, Ion Silviu Borozan, Inocentiu Maniu</i>	
<a href="#"><u>Algorithms in the Examination of the Postural Stability</u></a>	374
<i>L. Pivnickova, V. Vasek, V. Dolinay</i>	

<a href="#"><u>Neural Network Synthesis Dealing with Classification Problem</u></a>	377
<i>Pavel Varacha</i>	
<a href="#"><u>Entities of Critical Infrastructure Protection in the Czech Republic</u></a>	383
<i>Necosal Lubos, Ludek Lukas</i>	
<a href="#"><u>Modular Software for Artificial Arms Design</u></a>	387
<i>Eduard Franti, Gheorghe Stefan, Paul Schiopu, Anca Plavitu, Tiberiu Boros</i>	
<a href="#"><u>Automotive Active Suspension – Case Study on H-Infinity Control</u></a>	392
<i>Ales Kruczek, Antonin Stribrsky, Jaroslav Honcu, Martin Hlinovsky</i>	
<a href="#"><u>Fluid Seismic Modelling Inside Reservoirs Walls and Shipping Channel based on Transport Phenomena</u></a>	398
<i>Ioan Sorin Leoveanu, Daniel Taus, Kamila Kotrasova, Eva Kormanikova</i>	
<a href="#"><u>Usage of Peak Functions in Heat Load Modeling of District Heating System</u></a>	404
<i>Erik Kral, Lubomir Vasek, Viliam Dolinay, Petr Capek</i>	
<a href="#"><u>Protections of Embedded System Inputs</u></a>	407
<i>Otahal Jiri, Babik Zdenek, Tomas Surynek, Hruska Frantisek</i>	
<a href="#"><u>Visualization of Giant Connected Component in Directed Network - Preliminary Study</u></a>	412
<i>Eva Klimkova, Roman Senkerik, Ivan Zelinka, Tomas Sysala</i>	
<a href="#"><u>Prediction of the Intensity of Direct Solar Irradiation</u></a>	417
<i>Martina Svetinska, Lubomir Vasek</i>	
<a href="#"><u>LED based Ultraviolet Light Source</u></a>	421
<i>Michal Brazda, Martin Pospisilik, Milan Adamek</i>	
<a href="#"><u>Object Relation Data Model of Heat Distribution Network</u></a>	426
<i>Palka Jiri, Vasek Lubomir, Dolinay Viliam</i>	
<a href="#"><u>Concurrency Control for Mobile Transactions</u></a>	429
<i>Alaa Alnaimat</i>	
<a href="#"><u>Computer Fluid Dynamics Application for Establish the Wind Loading on the Surfaces of Tall Buildings</u></a>	433
<i>Ioan Sorin Leoveanu, Daniel Taus, Kamila Kotrasova, Eva Kormanikova</i>	
<a href="#"><u>Applications of Multilevel Cellular Automata in Epidemiology</u></a>	439
<i>Monica Dascalu, Gheorghe Stefan, Adrian Zafiu, Anca Plavitu</i>	
<a href="#"><u>Authors Index</u></a>	445