

Covered by Thomson Reuters

# applied mathematics and computer science

Special issue

ADVANCES IN CONTROL
AND FAULT-TOLERANT SYSTEMS

**Editors** 

Józef KORBICZ Didier MAQUIN Didier THEILLIOL





# Indexation

### About

The International Journal of Applied Mathematics and Computer Science is a quarterly published jointly by the University of Zielona Góra and the Lubuskie Scientific Society in Zielona Góra, Poland, since 1991. It strives to meet the demand for the presentation of interdisciplinary research in various fields related to control theory, applied mathematics, scientific computing, and computer science.

In particular, AMCS publishes high quality original research results in the following areas:

modern control theory and practice artificial intelligence methods and their applications applied mathematics and mathematical optimisation techniques mathematical methods in engineering, computer science, and biology.

### Current indexing and abstracting

Science Citation Index Expanded (SciSearch®), Journal Citation Reports/Science Edition, Scopus-Elsevier, Google Scholar, INSPEC, EBSCO, MathSciNet, Mathematical Reviews, Compendex, Zentralblatt MATH, Current Mathematical Publications, Computer Abstracts International Database, Applied Mechanics Reviews, ACM Digital Library, CSA Technology Research Database, CSA High Technology Research Database with Aerospace, Computer and Information Systems Abstracts, VINITI, BazTech, Polish Virtual Library of Science/Mathematical Collection, Digital Library of Zielona

### Impact Factor

0.794 (2010), 0.684 (2009)



### Associate Editors

Marian ADAMSKI

University of Zielona Góra, Poland

Igor AIZENBERG

. Texas A&M University-Texarkana, USA

Sergei AVDONIN

University of Alaska Fairbanks, USA

Stanisław BAŃKA

West Pomeranian University of Technology in Szczecin, Poland

Andrzej BARTOSZEWICZ Technical University of Łódź, Poland

Vincent COCQUEMPOT

Lille 1 University, France

Michael A. DEMETRIOU Worcester Polytechnic Institute, USA

Moritz DIEHL

KU Leuven, Belgium

Steven X. DING

University of Duisburg-Essen, Germany

Abdelhag EL JAI

University of Perpignan, France

Rolf FINDEISEN

University of Magdeburg, Germany

Luís GOMES

New University of Lisbon, Portugal

Adam GRZECH

Wrocław University of Technology, Poland

Bin JIANG

Nanjing University of Aeronautics and Astronautics, China

Janusz KACPRZYK

Polish Academy of Sciences, Warsaw, Poland

Nicholas P. KARAMPETAKIS

Aristotle University of Thessaloniki, Greece László KEVICZKY

Hungarian Academy of Sciences, Budapest, Hungary

Jerzy KLAMKA

Silesian University of Technology, Gliwice, Poland

Jacek KLUSKA

Rzeszów University of Technology, Poland

Jan M. KOŚCIELNY

Warsaw University of Technology, Poland

Zdzisław KOWALCZUK Gdańsk University of Technology, Poland

Krzysztof KOZŁOWSKI

Poznań University of Technology, Poland

Miroslav KRSTIC University of California, San Diego, USA

Marek KURZYŃSKI

Wrocław University of Technology, Poland

James LAM

University of Hong Kong, China Vyacheslav MAKSIMOV

Russian Academy of Sciences, Ural Branch, Ekaterinburg, Russia

Krzysztof MALINOWSKI Warsaw University of Technology, Poland

Wojciech MITKOWSKI

AGH University of Science and Technology, Cracow, Poland

Stanisław OSOWSKI

Warsaw University of Technology, Poland

Ronald J. PATTON University of Hull, UK Witold PEDRYCZ

University of Alberta, Edmonton, Canada

Marios M. POLYCARPOU

University of Cyprus, Nicosia, Cyprus

Vincenç PUIG

Technical University of Catalonia, Barcelona, Spain

Ewaryst RAFAJŁOWICZ Wrocław University of Technology, Poland

Eric ROGERS

University of Southampton, UK

Leszek RUTKOWSKI

Technical University of Częstochowa, Poland

Jose SÁ da COSTA

Technical University of Lisbon, Portugal

Dominique SAUTER

University of Lorraine, France

Alexey E. SHUMSKY

Pacific State Economic University, Vladivostok, Russia

Miroslav ŠIMANDL

University of West Bohemia in Pilsen, Czech Republic

Silvio SIMANI University of Ferrara, Italy

Roman SŁOWIŃSKI

Poznań University of Technology, Poland

Mircea-Traian SOFONEA University of Perpignan, France Jan SOKOLOWSKI University of Lorraine, France

Andrzej ŚWIERNIAK

Silesian University of Technology, Gliwice, Poland

Ryszard TADEUSIEWICZ

AGH University of Science and Technology, Cracow, Poland

Yonghong TAN

Shanghai Normal University, China

Piotr TATJEWSKI

Warsaw University of Technology, Poland

Krzysztof TCHOŃ

Wrocław University of Technology, Poland

Guisheng ZHAI

Shibaura Institute of Technology, Tokyo, Japan

Changshui ZHANG

Tsinghua University, Beijing, China

Enrique ZUAZUA

Basque Center for Applied Mathematics, Bilbao, Spain

Jacek M. ZURADA University of Louisville, USA

### Editor-in-Chief

Józef KORBICZ University of Zielona Góra, Poland

### **Deputy Editor**

Dariusz UCIŃSKI University of Zielona Góra, Poland

### **Editorial Office**

University of Zielona Góra Institute of Control & Computation Engineering ul. Podgórna 50

65-246 Zielona Góra Poland

tel.: +48 68 3282506 fax: +48 68 3284751

e-mail: amcs@uz.zgora.pl website: www.amcs.uz.zgora.pl

Agnieszka ROŻEWSKA

Manager

Agata WIŚNIEWSKA-KUBICKA Technical Editor





### Requirements in brief

Our basic rules include electronic paper submission and processing, the LaTeX format following a special *AMCS* style for paper final versions, copyright transfer, a voluntary page charge.

### Paper submission

Paper proposals may be submitted only through our on-line submission system as PDF files. If suitable for our journal, the papers will be subject to a full review procedure, and a decision on whether or not to accept the paper will be made based on the reviewers' comments.

### Electronic processing

The authors of accepted papers will be requested to provide the final versions of their work as electronic word processing files in the LaTeX format using our AMCS class.

### Paper style

The style of papers to be published in AMCS is determined by a special LaTeX class, which is described in detail in our instructions for authors.

### Copyright transfer

All authors must sign the copyright transfer agreement before the article can be published. The agreement allows protecting the copyrighted material, without affecting the authors' proprietary rights.

### Page charge

Papers published in AMCS are subject to a voluntary page charge, which will be invoiced through the author to the author's institution. Publication, however, is not dependent on the payment of this charge.

### **Provisions**

One sample copy of the journal and the electronic version of the paper are provided for authors once the issue has been published.

### Details, submission and downloads

The complete guide for authors can be found on our website at www.amcs.uz.zgora.pl.

### Present your research with us!



Our subscription is annual and covers four printed issues.

### 2012 Rates

### Domestic

Individuals & scientific institutions: 160 PLN Other customers: 600 PLN

Foreign

Individuals: 180 EUR Institutions: 200 EUR

The prices are VAT exclusive.

### Payment methods

We accept bank transfers and off-line credit card payments.

### Orders

Please contact the Editorial Office for subscription orders.



### Selected special issues and sections

2011, Vol. 21, No. 3: Special section ISSUES IN ADVANCED CONTROL AND DIAGNOSIS Editors: Vicenç PUIG, Marcin WITCZAK Authors: W. Chen, A. Khelassi, M. Bonfè, B. Boussaid, S. Fang, K-U Dettmann

2011, Vol. 21, No. 2: Special section
EFFICIENT RESOURCE MANAGEMENT FOR
GRID-ENABLED APPLICATIONS
Editors: Joanna KOŁODZIEJ, Fatos XHAFA
Authors: O. Terzo, A. Carpen-Amarie, J. Kołodziej, M. Hall-May,
H. González-Vélez, G. Di Modica, F.A. López-Fuentes

2011, Vol. 21, No. 1: Special section SEMANTIC KNOWLEDGE ENGINEERING Editors: Grzegorz J. NALEPA, Antoni LIGĘZA Authors: A.Bădică, J. Baumeister, J. Cañadas, I. Czarnowski, A. Kozierkiewicz-Hetmańska, A. Meissner

2010, Vol. 20, No. 1: Special section COMPUTATIONAL INTELLIGENCE IN MODERN CONTROL SYSTEMS Editors: Józef KORBICZ, Dariusz UCIŃSKI Authors: M. Ławryńczuk, K. Patan, G.J. Nalepa, R.K. Nowicki, D. Belter

2009, Vol. 19, No. 4: Special section ROBOT CONTROL THEORY Editor: Cezary ZIELIŃSKI Authors: K. Tchoń, M. Michałek, A. Mazur, P. Skrzypczyński

2009, Vol. 19, No. 3: Special issue VERIFIED METHODS: APPLICATIONS IN MEDICINE AND ENGINEERING Editors: Andreas RAUH, Ekaterina AUER, Eberhard P. HOFER, Wolfram LUTHER

Authors: B. G.-Tóth, A. Rauh, J.-P. Merlet, R. Pepy, N. Dimitrova, E. Auer, M. Tändl, M. Freihold, J.A. Enszer

## CONTENTS

Jamouli H., El Hail M.A. and Sauter D. A mixed active and passive GLR test for a fault tolerant control system	g
Uciński D. Sensor network scheduling for identification of spatially distributed processes	25
Yang F., Shah S.L. and Xiao D. Signed directed graph based modeling and its validation from process knowledge and process data	41
Ungermann M., Lunze J. and Schwarzmann D. Test signal generation for service diagnosis based on local structural properties	55
Niemann H.H. A model-based approach to fault-tolerant control	67
Yang H., Jiang B., Cocquempot V. and Lu L. Supervisory fault tolerant control with integrated fault detection and isolation: A switched system approach	87
Olive X. FDI(R) for satellites: How to deal with high availability and robustness in the space domain?	99
Edwards C., Alwi H. and Tan C.P. Sliding mode methods for fault detection and fault tolerant control with application to aerospace systems	109
Jain T., Yamé J.J. and Sauter D. Model-free reconfiguration mechanism for fault tolerance	125
Weber P., Boussaid B., Khelassi A., Theilliol D. and Aubrun C. Reconfigurable control design with integration of a reference governor and reliability indicators	139
Patton R.J., Chen L. and Klinkhieo S. An LPV pole-placement approach to friction compensation as an FTC problem	149
Montes de Oca S., Puig V., Witczak M. and Dziekan Ł. Fault-tolerant control strategy for actuator faults using LPV techniques: Application to a two degree of freedom helicopter	161
Gáspár P., Szabó Z. and Bokor J. LPV design of fault-tolerant control for road vehicles	173
Xu D., Jiang B. and Shi P. Nonlinear actuator fault estimation observer: An inverse system approach via a T-S fuzzy model.	183
Ichalal D., Marx B., Ragot J. and Maquin D. New fault tolerant control strategies for nonlinear Takagi—Sugeno systems	197
Yetendje A., Seron M.M. and De Doná J. Robust multisensor fault tolerant model-following MPC design for constrained systems	211
Patan K. and Korbicz J. Nonlinear model predictive control of a boiler unit: A fault tolerant control study	225

### **AIMS & SCOPE**

The *International Journal of Applied Mathematics and Computer Science* strives to meet the demand for the presentation of interdisciplinary research in various fields related to control theory, applied mathematics, scientific computing, and computer science. In particular, it publishes high quality original research results in the following areas:

- modern control theory and practice
- artificial intelligence methods and their applications
- applied mathematics and mathematical optimisation techniques
- mathematical methods in engineering, computer science, and biology.

We are primarily interested in presenting theoretical and application-oriented papers dealing with the following topics:

- artificial intelligence, including neural networks, knowledge engineering, reasoning and learning models, expert and decision support systems, fuzzy systems, and search methods
- control theory, including optimal control, system identification, adaptive and robust control, multivariable control, and non-linear systems
- dynamical systems, including spatiotemporal processes, control problems, sensor networks, and state and parameter estimation
- robotics, including modelling and simulation, mobile robots, and optimal trajectory planning
- fault detection and diagnosis, including model-based approaches, observers, and classifiers
- fault-tolerant control, including the control of continuous-variable and quantised systems
- mathematical biology
- mathematical modelling and simulation, including numerical algorithms
- optimisation, including mathematical optimisation techniques, global optimisation, and evolutionary algorithms
- pattern recognition
- signal processing
- applications in engineering and medicine.

The editors welcome proposals for exchange between similar journals. Also, all persons interested in bringing out special issues of *AMCS* are encouraged to contact the Editor-in-Chief. Such issues may be published on any important and timely subject within the scope of the journal. All papers proposed for specials should be referred and meet the same criteria for scientific quality as articles presented in regular issues.

The publication of *AMCS* is financially supported by the Ministry of Science and Higher Education in Poland and the University of Zielona Góra.

For more information, visit our website at www.amcs.uz.zgora.pl.