

DEPARTMENT OF SYSTEMS AND CONTROL

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The department is engaged in the analysis, control and optimization of systems and processes. The activities of the department are focused on the research of new methods and algorithms for automatic control, the development of procedures and tools to support the design and construction of control systems, the development of specific measurement and control modules, and the development and construction of complete systems for the control and supervision of machines, devices and industrial processes.

Basic and applied research

The basic and applied research in 2010 was devoted to three sub-areas: methodologies for analysis and control systems design; tools and building blocks for implementation; and applied research in the priority problem domains.

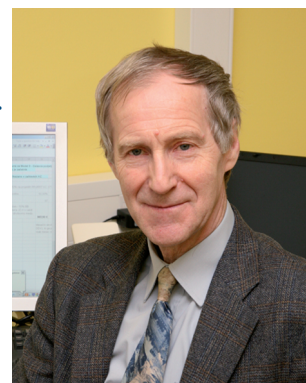
The sub-area methodologies for analysis and control systems design included three topics. The first topic addressed the modelling and identification of nonlinear and complex dynamical systems. The research in the dynamic systems modelling of Gaussian process models was directed towards the acceleration of dynamic systems identification with hardware, the modelling of multiple-input, multiple-output systems, and the application of modelling with Gaussian process models of environmental and traffic dynamic systems as well as biological systems (Fig. 2). The other part of this topic was related to the identification of stochastic nonlinear dynamical systems. A numerically efficient algorithm based on the optimisation of the likelihood function by means of the EM (expectation-maximization) approach has been developed. The UT (Unscented Transform) has been adopted to approximate the underlying probability density functions and its efficiency was compared with the Particle Filtering approach.

The second topic was (advanced) control. Within the research and development of explicit predictive controllers based on linear and hybrid models, the emphasis was on the problem of the reliable computation of parametric-controller partitions for numerically problematic cases and degeneracies, using methods of parametric quadratic programming and parametric linear complementarity. The other part of this topic was related to PID control. Research was focused on the implementation of the Magnitude Optimum (MO) method to unstable processes and integrating processes. For multivariable processes, the MO method was extended to controllers based on inverse decouplers.

The third topic of interest was condition monitoring and fault diagnosis. In this area the problem of fault detection in mechanical drives under weakly non-stationary operating conditions has been addressed. Under the assumption that neither speed nor load measurements are available, a novel feature has been proposed based on a wavelet analysis and an entropy measure has been developed. A validation on the experimental test bed clearly indicates a high diagnostic accuracy and an insensitivity to speed/load fluctuations.

New results have been obtained in the challenging area of estimating the remaining useful life of machines. A novel approach based on the on-line identification of wear processes and the prediction of fault progression has been proposed (Fig. 3).

A part of the work, which is also related to condition monitoring, dealt with the problem of monitoring the depth of anaesthesia (DOA). Our recent studies have shown that by studying the couplings between EEG frequency bands it is possible to discriminate between different states of anaesthesia in rats. Our latest work includes new measurements on humans during general anaesthesia, where the state of the anaesthesia was continuously assessed by anaesthetists. These new measurements will, first, allow us to correctly



Head:
Prof. Stanislav Strmčnik

At the Industrial forum IRT 2010 (Innovation, Development and Technology) the award “TARAS statuette” promoting innovation, development and technological excellence was granted to the program group Systems and Control of our department and to the company Domel, d.d. for successful cooperation in the development of the System for the Automatic End-Quality Assessment of Vacuum-Cleaner motors (Fig. 1).



Figure 1: Photo from the “TARAS statuette” award ceremony (from left to right: Andrej Biček, univ. dipl. ing., development engineer in the DOMEL company, dr. Jožica Rejec, president of the DOMEL management board, dr. Janko Petrovič, leader of the project team at our department, and prof.dr. Đani Juričić, leader of our research program)

At the third international Technology Transfer Conference, which was held in Ljubljana and Maribor, the committee of six foreign experts has awarded a group of researchers from our Department with the 2nd award. The award was granted for the Diagnostic and Prognostic Platform for Automated Condition Monitoring of Process Equipment. The recipients of the award were Đani Juričić, Petrovčič Janko, Bojan Musizza, Aleš Svetek, Pavle Boškosi, Matej Gašperin and Stanislav Černe.

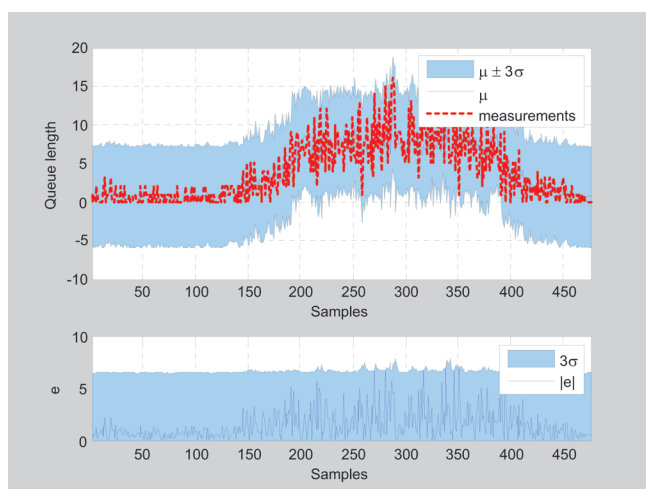


Figure 2: One-step-ahead predictions on data used for estimation (upper figure) and residuals of predictions with 3σ band (lower figure)

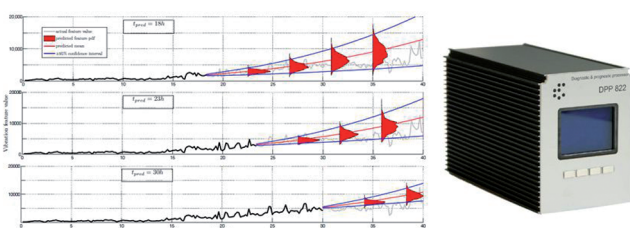


Figure 3: Prognosis of the remaining useful life of a machine; predicted distributions (left), a prototype system for automated condition monitoring and prognosis (right)

Among the seven selected applications of a public tender for the development of competence centres, published by the Ministry of Higher Education, Science and Technology, is also the Competence Centre for Advanced Control Technologies (CCA) in which our Department plays a crucial role. The competence centre includes 7 R&D projects with 17 partners.

map different states of anaesthesia to the value of EEG coupling index, and second, enable us to improve the robustness of the DOA prediction in humans.

The sub-area tools and building blocks for implementation also included three parts. The first part of our work was devoted to a further development of the program package for the rapid prototyping of advanced control algorithms. In the past year new algorithms for tuning integrating processes and for the robust identification of process parameters have been tested.

The second part included activities related to the development of tools and methods for control SW design. In this area an approach based on the model-driven engineering paradigm (MDE) for the development of industrial process control software (for controllers) was elaborated. This approach is defined through a sequence of development activities, a formalized ProcGraph modeling language, and a new version of the integrated development environment prototype.

In the third part, the HW platform for the first prototype of the diagnostic system DPP822 has been developed. The system is aimed at on-line condition monitoring and prognosis of the remaining useful life of mechanical drives (Fig.3). The system received the 2nd award for innovative solutions at the International Conference of Technology Transfer.

Applied research in the priority problem domains was the third sub-area of our interest.

In this frame a substantial part of our activities was devoted to the development of specific control systems described below.

In the past year we continued with the work related to the automatic landing of aircraft, based on onboard-camera-generated images. The research was focused on the completion of some control algorithms, the evaluation of their performance, and analyzing the conformity of the obtained landing trajectories with the prescribed standard requirements.

Within polymerization process control the real plant experiments were performed that confirmed the possibility of achieving a much more stable reactor temperature during the batch by applying the proposed on-line reactant-dosing control algorithm.

A novel approach to on-line sensor validation in cold rolling mills based on extended Kalman filtering has been developed. Of essential importance is the grey process model identified from the operating data. Statistical hypothesis tests are employed to detect sensor faults on the basis of a discrepancy between the measured value and the value predicted by the model. The work has been carried out in the frame of the international project PROBASENSOR as a part of the EUROSTARS project supporting initiative.

Control of wastewater treatment plants is our traditional research area. Within an applied research project in this area the ADM1-based simulation model of the sludge-treatment process in Domžale-Kamnik WWTP was designed and used to analyze the possibilities for increasing the biogas production by operating the anaerobic digesters at higher temperature and reduced volume.

Production control is also an important domain of our research work. The major problems in manufacturing today still relate to unexpected breakdowns and the degradation of product quality with no obvious reasons. Through the cooperation with the Kolektor Sinabit company a new system has been developed for acquiring process data from operating machines in a plastic extruding line. The preliminary sensitivity analysis of the product quality with respect to the process parameters has been performed by means of statistical tests. We have also proceeded with the evaluation of a hierarchical concept of model-based production control developed in previous years. The main focus in 2010 was on building the model from the operational data using neural networks.

In recent years, a part of our work was focused on the area of fuel cells. In 2010 the commercial system HyPM HD-200 was upgraded in order to measure various energy and material flows. The measurements performed have enabled

a calculation of the actual efficiency of a fuel-cells-based system and are the basis for designing advanced control algorithms for fuel-cell-based systems.

R&D projects for industry and other users

A significant part of the development activities of our department is oriented towards the implementation of fuel cells in various applications and to the development of special-purpose modules for fuel-cells-based generator sets. In 2010 the three-year project related to the development of a mobile experimental laboratory for hydrogen technologies research, referred to as TESTLAB, was completed. The laboratory consists of various interconnected subsystems including units for hydrogen production and storage, PEM fuel cells, electric and heat energy storages, electrical converters, etc., and is upgraded by a monitoring and computer control system (Fig. 4). The development related to fuel-cells-based systems applications has also been performed within the Centre of Excellence Low-carbon Technologies. Note that our group is leading this part of the activities within the centre.

The multidisciplinary project Kerapro, finished in the past year, was also related to fuel cells. Within this project prototypes of critical components of the miniature size fuel reformer were developed, which will serve as a source of hydrogen for miniature fuel cells. The project was financed by the Ministry of Defense of the Republic of Slovenia and carried out by four partners: Jožef Stefan Institute (Dept. of Electronic Ceramics and Dept. of Systems and Control), National Institute of Chemistry Slovenia (Laboratory of Catalysis and Chemical Reaction Engineering) and Hipot RR company.

As described below, an important part of our activities is also devoted to direct cooperation with various companies.

Based on the contract with the Domel company, Železniki, a diagnostic system for end-quality control of electrical motors of type 462 was developed. The system is characterized by a new set of manipulators, which enable a suitable acoustical and vibrational isolation of motors during measurements on the production line. The new system is the fifth in a row of similar, very successful diagnostic systems developed for Domel. Up till now, the implemented systems have been used to test more than 10 million motors.

An important part of the activities was, in the past year, performed in close cooperation with the INEA company. One of the activities to mention was the development of a new version of the batch-control tool. By the use of object solutions, the reuse of recipes has been increased and the user interface has been improved. Through the user-configurable used sequences, the flexibility of the phase behaviour model has been achieved. The transfer to a new powerful multiple CPU PLC platform was carried out, which also enabled the physical separation of the system and application software. The new version of the tool is marketed by Mitsubishi under the brand name Cbatch.

Another activity for the company INEA was related to the advanced demand response software solution for Smart Grids with the brand name KIBERnet. Based on the functional requirements, we implemented a program module for the calculation of user reliability. The module reads the adaptation data from the database and writes the calculated reliability factor into the database.

For the Brinox company we have carried out a research study on possible new approaches for a supervision system for a fluidized-bed machine used for agglomeration, coating and drying. The goal was to monitor the process via non-invasive measurements (analysis of pressure fluctuations and sound), which do not require any complex installations within the process equipment (Fig.5).

For the Plasmabull company we have been developing a control system for a new type of production machine using plasma for metal-plates processing. The machine will operate in batch mode; a great part of effort is being dedicated to the control of power distribution over the plate surface to achieve uniform processing.

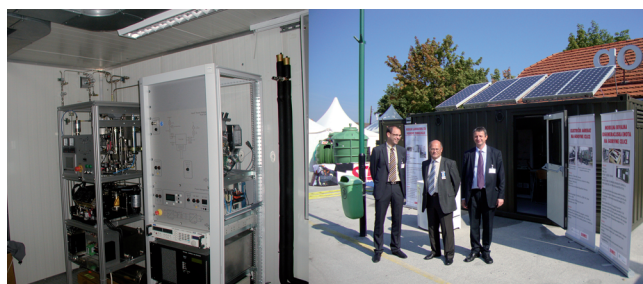


Figure 4: TESTLAB subunits: electrolyser, methanol reformer, fuel cells (left); Presentation of the mobile experimental laboratory TESTLAB at the event SOBRA 2010, G. Radgona, Slovenia (right)

At the 5th International Fair of Defence, Security, Protection and Rescue, SOBRA, which was held in Gornja Radgona, a mobile laboratory for hydrogen technologies was presented, which was jointly developed by our Department and the companies INEA d.o.o. and Domel d.d. (Fig.4)

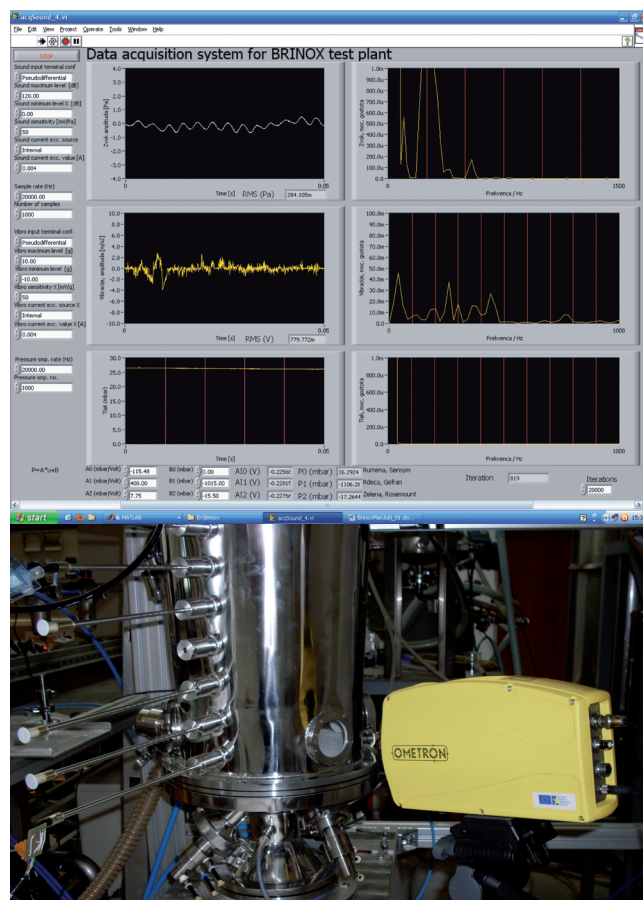


Figure 5: Supervision system for a fluidized bed process

“The Department of Systems and Control, Jožef Stefan Institute, is an excellent entity for applied research on control systems, covering nonlinear dynamics, fault-detection systems up to the implementation of control systems for industry.” This assessment has been given to our Department by international experts evaluating the level of knowledge and competencies usable in the area of space research.

In the past year we established a cooperation with the municipal company VO-KA in Ljubljana. A project considering the modelling of the Ljubljana Waste-Water Treatment Plant was started with the purpose to verify and optimise the conceptual design for the third stage of the plant construction, targeted to the desired elimination of nitrogen in waste water.

Other projects

In 2010 the activities on the project “Promoting Innovation in the Industrial Informatics and Embedded Systems Sector through Networking - I3E” funded by the “South East Europe-Transnational Cooperation Programme” have been continued. Its basic objectives are the promotion of innovation and entrepreneurship in the area of Southeast Europe with an emphasis on the development of advanced products and services in the sectors of industrial informatics and embedded systems. Our group participated at the definition of the Strategic Research Agenda, which is one of the essential results of the project. In October 2010 we also organised the national workshop where the aims, scope and the current results of the I3E project were presented to more than 100 participants.

Education and training activities

Some members of the department are giving lectures and practical courses at different faculties and universities: the Faculty of Electrical Engineering, University of Ljubljana, the Faculty of Logistics, University of Maribor, the University of Nova Gorica and the “Jožef Stefan” International Postgraduate School. They also act as supervisors of M.Sc. and Ph.D. students. Special care was given to post-qualification training for engineers from industry. In 2010, three one-week courses were organized. These courses were organized in close co-operation with the Faculty of Electrical Engineering, University of Ljubljana and the Information Technologies Knowledge Transfer Centre at the Jožef Stefan Institute.

Some outstanding publications in the past year

1. Matej Gašperin, Đani Juričić, Pavle Boškovski, Jože Vižintin. Model-based prognostics of gear health using stochastic dynamical models. *Mech. syst. signal process.*, [in press] 2010, 7 str., doi: 10.1016/j.ymsp.2010.07.003.
2. Pavle Boškovski, Janko Petrovčič, Bojan Musizza, Đani Juričić. Detection of lubrication starved bearings in electrical motors by means of vibration analysis. *Tribol. int.* [Print ed.], 2010, vol. 43, no. 9, str. 1683-1692, doi: 10.1016/j.triboint.2010.03.018.
3. Boštjan Pregelj, Samo Gerkišič. Hybrid explicit model predictive control of a nonlinear process approximated with a piecewise affine model. *J. process control.* [Print ed.], [in press] 2010, 8 str., doi: 10.1016/j.jprocont.2010.05.002
4. Vladimir Jovan, Matija Perne, Janko Petrovčič. An assessment of the energetic flows in a commercial PEM fuel cell system. *Energy convers. manage.* [Print ed.], 2010, vol. 51, no. 12, str. 2467-2472, doi: 10.1016/j.enconman.2010.04.014.

The most important technological achievement in the past year

1. TESTLAB - a mobile experimental laboratory for hydrogen technologies research, 2010, (in cooperation with companies INEA and DOMEL), (Vladimir Jovan, Janko Petrovčič, Aleš Svetek, Stane Černe, Primož Fajdiga, Miroslav Štrubelj)

Awards and appointments

1. Prof. Đani Juričić, Dr Janko Petrovčič, Dr Bojan Musizza, Aleš Svetek, Pavle Boškovski, Matej Gašperin and Stanislav Černe received the second award among the five awards for the innovation in the economy granted by six foreign experts at the third Technology Transfer Conference, held on 7-8 October 2010 in Ljubljana and Maribor. The award was granted for the development of Diagnostic and prognostic platform for automated condition monitoring of process equipment.
2. Domel, d.d. company and Systems and Control programme group at Jožef Stefan Institute were granted the TARAS statuette for successful cooperation in the development of a System for the automatic end-quality assessment of vacuum-cleaner motors. This award, recognizing the most successful cooperation between research teams and organisations on the one hand and development teams in industry and the economy on the other hand, as well as promoting innovation, development and technological excellence, was granted at the Industrial forum IRT 2010 (Innovation, development and technology), held in Portorož.

Organization of conferences, congress and meetings

1. Modelling and simulation of control systems: continuing education (specialisation) course in Control Technology, Ljubljana, 1–5 February 2010
2. Industrial regulation systems: continuing education (specialisation) course in Control Technology, Ljubljana, 12–16 April 2010
3. Advanced control methods: continuing education (specialisation) course in Control Technology, Ljubljana, 7–11 June 2010

INTERNATIONAL PROJECTS

1. Probabilistic Bayesian Soft Sensor - A Tool for On-line Estimation of the Key Process Variable in Cold Rolling Mills
ProBaSensor
EUROSTARS
COMPUREG Plzen, s.r.o., Czech Republic
Prof. Đani Juričić
2. Promoting Innovation in the Industrial Informatics and Embedded Systems Sectors through Networking
I3E
South East Europe Programme
SEE/A/219/1.1/X
Dr. Athanasios Kalogeras, Industrial Systems Institute / Research Centre ATHENA, Patras, Greece
Dr. Vladimir Jovan
3. Combining Soft Computing Techniques and Statistical Methods to Improve Data Analysis Solutions
SOFTSTAT
COST IC0702
EC; Cost Office, Brussels, Belgium
Prof. Juš Kocijan
4. Specification of the Automation System for the Metal Plate Treatment Machine Using Plasma
B0-10-0009
Primož Eiselt, PlasmaBull Engineering GmbH, Lebring, Austria
Dr. Gregor Dolanc
5. Application of Gaussian Processes to the Modelling and Control of Complex Stochastic Systems
BI-BG/09-10-005
Dr. Alexandra Grancharova, Institute of Control and System Research, Bulgarian Academy of Sciences (ICSR-BAS), Sofia, Bulgaria
Prof. Juš Kocijan
6. System Identification Based on Gaussian Process Model for Traffic Control Applications
BI-CZ/10-11-014
Dr. Jan Prikryl, Institute of Information Theory and Automation, Czech Academy of Science, Prague, Czech Republic
Prof. Juš Kocijan
2. Integrated Diagnostic System for Drive Assemblies
Prof. Đani Juričić
3. Modelling and Control of Wastewater Treatment Plants for Improving the Effluent Quality and Energy Effective Operation
Dr. Darko Vrečko
4. Advanced Model-based Procedures for Product Quality Control and Management in Complex Production Processes
Prof. Đani Juričić
5. Simplified Explicit Predictive Controller
Prof. Stanislav Strmčnik

RESEARCH PROGRAM

1. Program Systems and Control
Prof. Đani Juričić

NEW CONTRACTS

1. Freezing protection heaters for fuel cell power modules
INEA d.o.o.
Dr. Vladimir Jovan
2. Feasibility study of the supervision system of the fluidized bed agglomeration and deposition process
BRINOX INŽENIRING d.o.o.
Dr. Gregor Dolanc
3. Improvement of industrial diagnostic systems for Domel
DOMEL, d.o.o.
Dr. Janko Petrovčič
4. Review of preliminary design of the Ljubljana Waste Water Treatment Plant - Phase III construction
JP Vodovod-Kanalizacija d.o.o.
Dr. Nadja Hvala
5. Batch client specification
INEA d.o.o.
Giovanni Godena, M. Sc.
6. Operater panel interface specification
INEA d.o.o.
Giovanni Godena, M. Sc.
7. A diagnostic system for vacuum cleaner motors on the production line ML7
DOMEL, d.o.o.
Dr. Janko Petrovčič

R & D GRANTS AND CONTRACTS

1. Identification and Model Analysis for Dynamic Systems Control Design with Gaussian Process Priors
Prof. Juš Kocijan

VISITORS FROM ABROAD

1. Dr. Kosta Boshnakov, University of Chemical Technology and Metallurgy, Sofia, Bulgaria, 28 May 2010
2. Pavle Boškovski, Elektrotehnički fakultet, Univerzitet Sv. Kiril i Metodij, Skopje, R. Macedonia, 1 January to 31 December 2010
3. dr. Jan Prikryl, Institute of Information Theory and Automation, Czech Academy of Sciences, Prague, Czech Republic, 17 October to 14 November 2010
4. Jan Šindlář, Institute of Information Theory and Automation, Czech Academy of Sciences, Prague, Czech Republic, 31 October to 7 November 2010
5. Kateřina Zemánková, Institute of Information Theory and Automation, Czech Academy of Sciences, Prague, Czech Republic, 31 October to 7 November 2010
6. Hristina Hristova, Institute of Control and System Research, Bulgarian Academy of Sciences, Sofia, Bulgaria, olgarija, 8–17 November 2010
7. Aleksander Krastov, Institute of Control and System Research, Bulgarian Academy of Sciences, Sofia, Bulgaria, 8–17 November 2010
8. Prof. Stefan Jakubek, Technische universität Wien, Vienna, Austria, 7 December 2010

STAFF

Researchers

1. Dr. Gregor Dolanc
 2. Dr. Samo Gerškovič
 3. Giovanni Godena, M. Sc.
 4. Dr. Dejan Gradišar
 5. Dr. Nadja Hvala
 6. Dr. Vladimir Jovan
 7. Prof. Đani Juričić
 8. Dr. Gregor Kandare
 9. Prof. Juš Kocijan
 10. Dr. Janko Petrovčič
 11. **Prof. Stanislav Strmčnik, Head**
 12. Asst. Prof. Damir Vrančič
 13. Dr. Darko Vrečko
- ### Postdoctoral associates
14. Dr. Bojan Musizza
 15. Dr. Boštjan Pregelj
 16. Dr. Alenka Žnidaršič*, left 01.11.10

Postgraduates

17. Matej Gašperin, B. Sc.
18. Miha Glavan, B. Sc.
19. Tomaž Lukman, B. Sc.
20. Satja Lumbar, B. Sc.
21. Jernej Mrovlje, B. Sc.
22. Dejan Petelin, B. Sc.
23. Aleš Svetek, M. Sc.

Technical officers

24. Stanislav Černe, B. Sc.
25. Primož Fajdiga, B. Sc.
26. Dr. Zoran Marinšek*

Technical and administrative staff

27. Maja Janežič, B. Sc.
28. Miroslav Štrubelj

Note:

* part-time JSI member

BIBLIOGRAPHY

ORIGINAL ARTICLES

1. Pavle Boškosi, Janko Petrovčič, Bojan Musizza, Đani Juričić, "Detection of lubrication starved bearings in electrical motors by means of vibration analysis", *Tribol. int.*, vol. 43, no. 9, pp. 1683-1692, 2010.
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3. Giovanni Godena, Janez Tancek, Igor Steiner, "Ein Kochbuch für Charginprozesse", *IEE (Heidelb.)*, no. 11, pp. 144-147, 2010.
4. Dejan Gradišar, Antonio Espuña, Luis Puigjaner, "Komunikacijska shema za celovito vodenje šaržnih procesov", *Ventil (Ljubl.)*, vol. 16, no. 2, pp. 152-155, 2010.
5. Jurij Jaklič, Aleš Popovič, Tomaž Lukman, "Zrelost poslovne inteligence v slovenskih organizacijah", *Uporab. inform. (Ljubl.)*, vol. 18, no. 1, pp. 16-31, jan./feb./mar. 2010.
6. Matej Jerala, Vladimir Jovan, Jure Vindišar, Peter Nemček, "Vodik - energent prihodnosti?", *EGES, Energ. gospod. okol. Slov.*, vol. 14, no. 1, pp. 82-85, 2010.
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8. Gregor Kandare, Antonio Nevado Reviriego, "Adaptivno prediktivno vodenje raztopljenega kisika v bioloških reaktorjih čistilnih naprav", *Ventil (Ljubl.)*, vol. 16, no. 6, pp. 540-546, 2010.
9. Gregor Kandare, Stanko Strmčnik, Giovanni Godena, "Domain specific model-based development of software for programmable logic controllers", *Comput. ind.*, vol. 61, no. 5, pp. 419-431, 2010.
10. Michail E. Keramidas, Bojan Musizza, Stylianos N. Kounalakis, Igor B. Mekjavić, "Enhancement of the finger cold-induced vasodilation response with exercise training", *Eur. j. appl. physiol. (Print)*, vol. 109, no. 1, pp. 133-140, 2010.
11. Juš Kocijan, Alexandra Grancharova, "Gaussian process modelling case study with multiple outputs", *Dokl. B'lg. akad. nauk.*, vol. 63, no. 4, pp. 601-607, 2010.
12. Jernej Mrovlje, "Vpliv distorzije na razdalje, izračunane s pomočjo stereoskopskih slik", *Elektroteh. vestn.*, vol. 77, no. 1, pp. 43-48, 2010.
13. Aleš Svetek, Damir Vrančič, Samo Krančan, Zoran Šaponja, "Adaptivni inteligentni ventil", *Ventil (Ljubl.)*, vol. 16, no. 3, pp. 252-258, jun. 2010.
14. Simon Štampar, Saša Sokolič, Gorazd Karer, Alenka Žnidaršič, Igor Škrjanc, "Theoretical and fuzzy modelling of a pharmaceutical batch reactor", *Math. comput. model.*, vol., no., pp. 1-9, 2010.
15. Damir Vrančič, Stanko Strmčnik, Juš Kocijan, P. B. de Moura Oliveira, "Improving disturbance rejection of PID controllers by means of the

magnitude optimum method", *ISA trans.*, vol. 49, no. 1, pp. 47-56, 2010.

16. Darko Vrečko, Anton Ložar, Vladimir Vrečko, Vladimir Jovan, "Programsko orodje za razvrščanje šarž v pripravi surovin v Cinkarni Celje", *Ventil (Ljubl.)*, vol. 16, no. 3, pp. 260-265, 2010.

REVIEW ARTICLES AND CHAPTERS IN BOOKS

1. Bojan Musizza, Samo Ribarič, "Monitoring the depth of anaesthesia", *Sensors*, vol. 10, no.12, pp. 10896-10935, 2010.

PUBLISHED CONFERENCE PAPERS

Regular papers

1. Andrej Biček, Janko Petrovčič, Bojan Musizza, Gregor Dolanc, Janez Koblar, Dejan Petelin, Đani Juričić, "Sistem za avtomatsko končno kontrolo elektromotorjev", In: *Vir znanja in izkušnje za stroko: zbornik foruma, Industrijski forum IRT, Portorož, 7.-8. junij 2010*, Tomaž Perme, ed., Darko Svetek, ed., Jože Balič, ed., Škofljica, Profidtp, 2010, pp. 41-46.
2. Pavle Boškosi, Đani Juričić, Mile J. Stankovski, Jože Vižintin, "Wavelet based information cost functions for condition monitoring", In: *Zbornik predavanj Posvetovanja o tribologiji, mazivih in alternativnih gorivih*, Jože Vižintin, ed., Igor Velkavrh, ed., Bojan Podgornik, ed., Ljubljana, Slovensko društvo za tribologijo, = Slovenian Society for Tribology, 2010, pp. 241-254.
3. Pavle Boškosi, Janko Petrovčič, Bojan Musizza, Đani Juričić, "Final quality assessment system of electronically commutated motors", In: *CM 2010/MFPT 2010*, The 7th International Conference on Condition Monitoring and Machinery Failure Prevention Technologies, 22-24 June 2010, Etington Chase, Stratford-upon-Avon, England, Northampton, The British Institute of NT, 2010, 12 pp.
4. Stanislav Černe, Janko Petrovčič, Aleš Belič, "Merilni sistem za določanje karakteristik hladilnih naprav za sisteme z gorivnimi celicami", In: *Zbornik devetnajste mednarodne Elektrotehniške in računalniške konference ERK 2010, Portorož, Slovenija, 20.-22. september 2010*, (Zbornik ... Elektrotehniške in računalniške konference ERK ...), Baldomir Zajc, ed., Andrej Trost, ed., Ljubljana, IEEE Region 8, Slovenska sekcija IEEE, 2010, zv. A, pp. 307-310.
5. Matej Gašperin, Đani Juričić, "Model-based prognostics of mechanical drives: the maximum-likelihood approach", In: *Zbornik devetnajste mednarodne Elektrotehniške in računalniške konference ERK 2010, Portorož, Slovenija, 20.-22. september 2010*, (Zbornik ... Elektrotehniške in računalniške konference ERK ...), Baldomir Zajc, ed., Andrej Trost,

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