FACULTY OF AUTOMATION AND COMPUTERS

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RESEARCH CENTER IN AUTOMATION AND COMPUTERS C.C.S.-A.C.

GENERAL PRESENTATION

The main aim of the centre is to develop high-level research in the fields of automatic control, computer and software engineering and information technology. It offers the research results in these fields to interested companies and organizations all over the world.

Head of the Research Centre: ***Prof. dr. eng. Stefan PREITL***

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The Centre is organised in two research divisions:
➢ *Research Division in Automation and Industrial Informatics*
Head of the division: Prof. dr. eng. R.E. Precup
➢ *Research Division in Computer Science and Engineering*
Head of the division: Prof. dr. eng. Marius Crişan

AWARDS

Prof. dr. eng. Nicolae Budişan was awarded the *Aurel Vlaicu* Prize of the Romanian Academy
Prof. dr. eng. Radu-Emil Precup and Prof. dr. eng. Stefan Preitl, were awarded the *Grigore Moisil* Prize of the Romanian Academy

RESEARCH DIVISION IN AUTOMATION AND INDUSTRIAL INFORMATICS

CONTACT

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Researches in *PROCESS CONTROL*

RESEARCH TEAM

➢ Prof. dr. eng. Stefan Preitl, head of the team
➢ Prof. dr. eng. Radu-Emil Precup
➢ Assist. eng. Levente Kovacs, PhD student
➢ Assist. eng. Zsuzsa Preitl, PhD student
➢ Assist. eng. Simona Gheju, PhD student.

RESEARCH FIELDS

➢ Control systems with conventional controllers
➢ Advanced control systems.

KEYWORDS

Fuzzy logic control; sliding mode control; intelligent systems; stability analysis; sensitivity analysis; mobile robots; 2-DOF controllers; servo systems; embedded systems.

MAIN ACTIVITIES

➢ Development of conventional and advanced control systems
➢ Development of adaptive control systems
➢ Soft computing in industrial applications
➢ Development of control systems for servo systems
➢ Development of control systems for mobile robots.

RESULTS

PUBLISHED PAPERS

1. Preitl, St., Precup, R.-E., Preitl, Zs., *Development of Conventional and Fuzzy Controllers and Takagi-Sugeno Fuzzy Models Dedicated for Control of Low Order Benchmarks with Time Variable Parameters*, Acta Polytechnica Hungarica, Budapest Tech Polytehnical Institution, Budapest, Hungary, ISSN 1785-8860, vol. 2, no.1, 2005, pp. 75–92

2. Precup, R.-E., Preitl, St., Szabo, Cs., Korondi, P. Szemes, P., *On Some Low-Cost Tracking Controllers for Mobile Robots*, Control and Intelligent Systems, Acta Press, ISSN 1480-1752, vol. 33, no. 1, 2005, pp. 1–12

3. Precup, R.-E., Preitl, St., *On the Stability and Sensitivity Analysis of Fuzzy Control Systems for Servo-Systems*, Chapter 6 in "Fuzzy Systems Engineering – Theory and Practice", Editors: N. Nedjah, L. de Macedo Mourelle, Studies in Fuzziness and Soft Computing, vol. 181, Springer-Verlag, Berlin, Heidelberg, 2005, ISBN (978)-3-540-25322-X, ISSN 1434-9922, pp. 131–161

4. Preitl, St., Precup, R.-E., Preitl, Zs., *Sensitivity Analysis of Low Cost Fuzzy Controlled Servo Systems*, 16th World Congress of International Federation of Automatic Control 2005, Prague, Czech Republic, Preprints, Editors: P. Horacek, M. Simandl, P. Zitek, DVD, paper index 1794, 6 pages

5. Precup, R.-E., Preitl, St., *Stability Analysis of Fuzzy Control Systems. Multivariable Point of View*, 16th World Congress of International Federation of Automatic Control 2005, Prague, Czech Republic, Preprints, Editors: P. Horacek, M. Simandl, P. Zitek, DVD, paper index 01794, 6 pages

6. Precup, R.-E., Preitl, Zs., Kilyeni, St., *Fuzzy Control Solution for Hydro Turbine Generators*, 2005 IEEE International Conference on Control and Automation (ICCA2005), Budapest, Hungary, ISBN 0-7803-9138-1, Proceedings, pp. 83 – 88

7. Preitl, St., Precup, R.-E., Preitl, Zs., *Two Degree of Freedom Takagi-Sugeno Fuzzy Controllers in Trajectory Tracking*, International Carpathian Control Conference ICCC'2005, Miskolc-Lillafured, Hungary, Proceedings, Editors: T. Adam, P. Serfozo, A.K. Varga, J. Vasarhelyi, ISBN 963-661-644-2, vol. I, pp. 273 – 278

8. Precup, R.-E., Preitl, St., *On a Class of Control Systems with Takagi-Sugeno PI-Fuzzy Controllers*, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence – SACI 2005, Timişoara, Romania, Proceedings, ISBN 963-7154-39-6, pp. 45 – 58

9. Ardelean, C., Graeser, A., Mihajlov, M., Precup, R.-E., *Applications of Iterative Feedback Tuning in PI and PID Controller Design*, Scientific Bulletin of the "Politehnica" University of Timişoara, Series Automation and Computers, Politehnica Publishing House, Timişoara, ISSN 1224-600X, vol. 50 (64), 2005, pp. 11 – 16

10. Precup, R.-E., Preitl, St., *Stability and Sensitivity Analysis of Fuzzy Control Systems. Mechatronics Applications*, 6th International Symposium of Hungarian Researchers on Computational Intelligence, Budapest, Hungary, Proceedings, 2005, ISBN 963-7154-43-4, pp. 130 – 143

11. Preitl, Zs., *Improving Disturbance Rejection by Means of a Double Parameterization of the Symmetrical Optimum Method,* Scientific Bulletin of the "Politehnica" University of Timişoara, Series Automation and Computers, Politehnica Publishing House, Timişoara, ISSN 1224-600X, vol. 50(64), 2005, pp. 25-34

12. Preitl, Zs., Bars, Ruth, Vajk, I., Haber, R., *Cascade GPC with Minimax Optimal Inner Control Loop*, International Carpathian Control Conference ICCC'2005, Miskolc-Lillafured, Hungary, Proceedings, Editors: T. Adam, P. Serfozo, A.K. Varga, J. Vasarhelyi, ISBN 963-661-644-2, vol. I, 2005, pp. 323 – 328

13. Kovacs, L., Paláncz B., Benyó Z., *Classical and Modern Control Strategies in Glucose-Insulin Stabilization*, 16th World Congress of International Federation of Automatic Control – 2005, Prague, Czech Republic, Preprints, Editors: P. Horacek, M. Simandl, P. Zitek, DVD, paper index 4165, 6 pages

RESEARCH GRANTS AND PROJECTS

National grants and projects

1. Research Grant of the National University Research Council (CNCSIS), Type A no. T26/ 2005, CNCSIS code 190, Title: *Development of Control Structures and Controllers for Positioning Systems.* Director: Prof.dr.eng. Stefan Preitl, (grant value for 2005: 22,000 RON)

The development of design and tuning methods for conventional PI and PID controllers applicable to variable parameter plants is actually by taking into account the large use of controllers with dynamics when coping with this type of applications. The 2-DOF controllers are also widely used due to the good control system performance they can achieve with respect to both the reference and the disturbance inputs. A combination within 2-DOF and fuzzy control represents a relatively new domain of automatic control with exquisite potential applications in the control of servo systems that are subject to difficult analytical modeling. The Youla parameterization (also the Q – parametrization) is a modern control design method suitable for both stable and unstable plants. In the design phase systems with electrical drives can be well approximated through low order linear models called benchmarks, and for such system it can be advantageous to use control design based on modulus optimum criterion. The main referred applications are in field of mobile robots and electro-hydraulic servo systems. For example, the control of nonholonomic mobile robots is of interest due to the implications of nonholonomic constraints. The majority of controllers for these robots are based on either kinematic models, or dynamic models. But, the dynamic models do not exploit the dynamics of the actuators, of the measuring devices and of the control equipment. Since the development of tracking controllers based on the current approaches is rather complex, it is necessary to simplify it for further implementations. The development methodologies must be systematic and this was one of the objectives fulfilled in the framework of the grant.

2. Research Grant of the National University Research Council (CNCSIS), Type A, no. T25/2005, CNCSIS code 189, Title:

Development of New Fuzzy Controller Structures Based on Sensitivity Theory. Director: Prof.dr.eng. Radu-Emil Precup (grant value for 2005: 27,000 RON)

The sensitivity analysis of fuzzy control systems (FCSs) with respect to the parametric variations of the controlled plant is necessary because the behavior of these systems is generally reported as 'robust' or 'insensitive' without offering systematic analysis tools. The sensitivity analysis performed in the project is based on the idea of approximate equivalence between the FCSs and the linear control systems, in certain conditions.

Fuzzy control represents a relatively new domain of automatic control with exquisite potential applications in the control of plants that are subject to difficult analytical modeling. This is the case of anti-lock braking systems and of mobile robots. Sliding mode control systems represent a particular case of variable structure systems, and they have advantages such as relatively high robustness and good dynamic performance. The grant focused on development methods and controller structures based on the sensitivity analysis of the control systems involved ensuring low sensitivity.

International grants and projects

1. Bilateral research contract, 2003-2005, with Budapest University of Technology and Economics (B.M.E.), Hungary; Theme: *Nonlinear systems and control in the field of power electronics*; Directors Prof.dr.eng. Ştefan PREITL (P.U.T., Romanian partner) and Acad. Istvan NAGY (B.M.E., Hungarian partner) *(The Agreement of the Second Romanian-Hungarian Session of Scientific and Technologic Co-operation, signed in Budapest, 07.03.2003, Appendix 2, pos. 16 Ro-18/2002, MCT no. C-18015 / 26.03.2003)*

Nowadays nonlinear dynamic systems are in the focus of research interest of scientists. The co-operation during 2005 has embraced and oriented on three topics in the broad field of the Application of Nonlinear Dynamics in Emerging Technologies. They are: Servo systems; Feedback controlled nonlinear dynamic variable structure systems with single and multi loops in power electronics and motion control; Intelligent Space; Development of nonlinear controllers for mobile robots.

Research fields in this framework:

➢ Prof.dr.eng. Ştefan Preitl, Prof.dr.eng. Radu-Emil Precup, Lect. Florin Drăgan, Assist.eng. Emil Voişan, Assist.eng. Zsuzsa Preitl, Acad. Istvan Nagy, Assoc.prof. Ruth Bars: *Structures and algorithms for linear and nonlinear control algorithms. Control algorithms for power electronic circuits*
➢ Prof.dr.eng. Ştefan Preitl, Prof.dr.eng. Radu-Emil Precup, Assist.eng. Levente Kovacs,

Prof. Zoltan Benyo: *Study of multivariable systems with applications in bio-systems and bio-medical systems*

➢ Prof.dr.eng. Radu-Emil Precup, Prof.dr.eng. Ştefan Preitl, Assist.eng. Simona Gheju, Prof. Peter Baranyi, Assoc.prof. Peter Korondi: *Analysis and development of fuzzy controllers*

2. *Submitted project proposal* as part of the Sixth European Framework in the field of controlling new electrical machines with emphasis on robot control: "Entwicklung eines Modells und eines Regelalgorithmus für die Transverse Flux Machine", partners: University of Bremen and companies from Germany and Romania.

PERSPECTIVE DOMAINS

➢ New methods for the algorithmic design of conventional and intelligent controllers (fuzzy, neural, genetic, sliding mode)
➢ Methods for computer-aided design of control systems
➢ Control solutions in the fields of power systems, electrical drives, general industrial automation, mobile robots.

STRATEGIC PRIORITIES

➢ Control systems ensuring low sensitivity
➢ Tools for computer-aided design of 2-DOF controllers
➢ Computer-aided techniques in Iterative Feedback Tuning
➢ Low cost solutions for control problems dedicated to mobile robots
➢ Methods and tools to enable the systematic development of fuzzy control systems.

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Researches in *SYSTEM IDENTIFICATION, ADAPTIVE SYSTEMS*

RESEARCH TEAM

- Prof. dr. eng. Octavian Proştean, head of the team
- Prof. dr. eng. Nicolae Budişan
- Assoc. prof. dr. eng. Ioan Filip
- Assist. eng. Iosif Szeidert, PhD student
- Assist. eng. Cristian Vaşar, PhD student

RESEARCH FIELDS

- System's modeling, identification and simulation
- Unconventional energetic
- Neural networks and fuzzy systems
- Adaptive control systems.

KEYWORDS

Modeling, identification and simulation of systems, neural networks and fuzzy systems, wind energy conversion systems, unconventional energetic, adaptive control, self-tuning.

MAIN ACTIVITIES

- Modeling, simulation and development of wind energy conversion systems (WECS)
- Identification and parameter estimation of electrical machines (asynchronous and synchronous)
- Development of new enhanced electrical machines types
- Development of control systems for WECS
- Control software development in industrial applications
- Modeling and simulation of systems with neural networks
- Development of WECS software
- Development of adaptive control structures
- Development of data aqcuisition systems.

PUBLICATIONS

PUBLISHED PAPERS

1. Szeidert, I., Budisan, N., Filip, I., Szeidert, R., *Consideration and Perspectives about Wind Energy Usage in Romania,* Symposium "Electrotechnics and Energetics, Timis Academic Days, ISBN 973-625-253-3, CD-ROM, 2005

2. Prostean, O., Szeidert, I., Budisan, N., Prostean, G., Vasar, C., *Mathematical models of specific elements of wind energy conversion systems based on induction generator*, Symposium "Electrotechnics and Energetics, Timis Academic Days, ISBN 973-625-253-3, CD-ROM, 2005

3. Prostean, O., Filip, I., Szeidert, I., Vasar, C., *Design An Simulation of Two Adaptive Self-Tuning Controllers With Application To A Power System*, SACI 2005, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence, Timisoara, Romania, 2005, ISBN 963-7154 39-6, pp. 121 – 129

4. Szeidert, I., Prostean, O., Filip, I., Budisan, N., Vasar, C., *Considerations Above Modelling and Control of Windmills,* SACI 2005, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence, Timisoara, Romania, 2005, ISBN 963-7154-39-6, pp. 417 – 425

5. Filip, I., Prostean, O., *Modeling, Parameters Estimation and Adaptive Control of a Synchronous Generator*, Control Engineering and Applied Informatics Journal (CEAI), Bucharest, Romania, ISSN 1454-8658, vol. 7, no. 1, 2005, pp. 20 – 30

6. Prostean, O., Filip, I., Vasar, C., Szeidert, I., *Inverse Control Based On Neural Networks*, Scientific Bulletin of „Politehnica" University of Timisoara, Romania, Transactions on Automatic Control and Computer Science, vol. 50(64), 2005, ISSN 1224-600X, pp. 35-40

RESEARCH GRANTS AND PROJECTS

National grants and projects

1. National University Research Council CNCSIS, Romania, research grant "*Researches regarding new electromechanical energy conversion automatic systems, with induction machines, with application to wind aggregates*", Grant Type A, Theme no. 26, code 628, Director: Prof.dr.eng. Octavian Prostean, Financed value 20,000 RON

The proposed grant has the aim, goal and objectives related to the CNSCIS priority research domain, researches regarding increasing the rate of WECS usage as a environmental friendly energy resource leading to the reduction of carbon emissions a of the pollution, due the usage of non-ecological resources, highly polluting, conform to the global ecological tendency of energy production. The aim will be fulfilled by novel renewable resources energy electromechanical conversion automatic systems based on squirrel cage induction machines, with physical decoupling of the active and reactive current components, used in variable speed wind energy conversion systems (WECS) with advanced control. The factors that determine the WECS performances are at windmills are the type, construction, generator's usage method and the control system of the WECS. The proposed project will contribute to the scientific development in this field, reported to the most competitive solutions resulted from the technical literature.

2. National University Research Council CNCSIS, Romania, research grant "*Researches regarding the synthesis and implementation on digital signal processors of self-tuning adaptive control strategies with application to the excitation's command of sychnoronous generators*", Grant Type A, theme no. 13, code 659, Director: Assoc. prof.dr.eng. Ioan Filip, Financed value 15,000 RON

The proposed grant has the aim, goal and objectives related to the CNSCIS priority research domain, researches regarding the developing of new self-tuning control algorithms particularized and implemented on DSP with application to the excitation control of a synchronous generator. The synchronous generator is a non-linear process with a complex dynamic, in which the characteristics fluctuate with the varying parameters and permanently perturbed by a stochastic noise. Starting with these models, there will be conducted the design of self-tuning control system, by integrating a parameter estimation algorithm with the control law and validation through simulations specific to the synchronous generator operating regimes. The last phase is the solving of characteristic issues regarding the software implementation on a DSP embedded hardware support.

PERSPECTIVE DOMAINS

➢ Real time control of induction machines using LabView (LabWindowsCVI) using the National Instruments Data Acquisition Systems

➢ Advanced control of wind aggregates

➢ Neural network control systems.

STRATEGIC PRIORITIES

➢ Study of innovative control systems for wind aggregates: improved adaptive step Hill climbing method (HCC)

➢ Tools for statistical wind measurement related data, for short-term forecasting used in wind speed prediction based windmill's control systems and for simulation of autonomous wind farms aggregates (new Matlab tools).

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Researches in *APPLIED INFORMATICS*

RESEARCH TEAM

➢ Prof.dr.eng. Vasile Stoicu-Tivadar, head of the team
➢ Prof.dr.eng. Lăcrămioara Stoicu-Tivadar
➢ Assist.eng. Ioan-Daniel Ardelian
➢ Assist.eng. Bogdan Solga
➢ Eng. Dorin Berian, PhD Student

RESEARCH FIELDS

➢ Health Information Systems, E-Health, Telemedicine
➢ Embedded and Real-time Systems
➢ Distributed and Mobile Applications.

KEYWORDS
Distributed medical informatics; applied informatics; telemedicine; e-administration.

MAIN ACTIVITIES

➢ Implementation of a telemedicine application between the Timis County Hospital and Italian Hospitals
➢ Development of distributed document flow–based software for the Timis County Council administration
➢ Development of mobile applications in medical informatics
➢ Study and development of different solutions for integrated healthcare networks.

RESULTS

PUBLISHED PAPERS

1. Stoicu-Tivadar, V., Stoicu-Tivadar, L., Mărginean, M., Berian, D., *E-Health Network Projects - Life after Life*, ENMI (European Notes in Medical Informatics), vol. 1, no. 1, 2005, ISSN 1861-3179, pp. 1178 – 1183

2. Stoicu-Tivadar, V., Stoicu-Tivadar, L., Mărginean, M., *Medical Informatics Education and Human Resources Management Based on a National GP Sentinel Network Experience*, Health and Medical Informatics Applications - Educational Aspects, Special Topics Conference STC2005, Athens, Greece, Aka GmbH Berlin & IOS Press, 2005, ISBN 3-89838-062-9, pp. 151 – 153

3. Robu, N., Stoicu-Tivadar, V., Silea, I., Albu, A., Berian, D., Vlasiu, G., *A flexible solution for the external database of a Lotus-based Regional E-Administration Network*, Proceedings of 6th International Carpathian Control Conference ICCC2005, Miskolc-Lillafured, Hungary, 2005, ISBN 963-661-644-2, pp. 471 – 475

4. Robu, N,. Stoicu-Tivadar, V., Silea, I., Stoicu-Tivadar, L., Albu, A., Berian, D., Vlasiu, G., *Lotus Solutions for a Regional E-administration Network*, Proceeedings of SACI 2005, 2nd Romanian Hungarian Joint Symposium on Applied Computational Intelligence, Timişoara, Romania, 2005, ISBN 963-7154-39-6, pp. 11 – 21

5. Robu, N., Stoicu-Tivadar, V., Silea, I., Stoicu-Tivadar, L., Albu, A., Berian, D., Vlasiu, G., *Managing the Development of a Regional E-administration Network with Academic Expertise,* Proceedings of IEEE 3rd International Conference on Computational Cybernetics, Mauritius, 2005, ISBN 963 7154 37 X, pp. 319 – 324

RESEARCH GRANTS AND PROJECTS

Bilateral project Italy-Romania: System for teleconsultation between hospitals.

Participants: Francesco Sicurello (@ITIM Associazione Italiana di Telemedicina e Informatica Medica, University Milano-Biccoca), Lacramioara Stoicu-Tivadar (Politehnica University Timisoara), Vasile Stoicu-Tivadar (Politehnica University Timisoara), Gianni Pellicano (Hospital Careggi Florence), Victor Moga (County Hospital Timisoara), Mariana Moga (County Hospital Timisoara), Gianluca Ronco (Sirse Italy).

The goal of the project was to interconnect two hospitals, one from Timisoara (County Hospital) and one from Italy (Carregi, Florence) in order to provide communication support between doctors from several departments. The benefit of the project was the development of a community of Romanian and Italian doctors echanging experience and starting the building of a platform of communication between the doctors regarding health problems of Italian residents in Timisoara.

The role of the team from PUT was to coordinate the activities in Timisoara: connection with the hospital personell, design of the communication structure, technical assitance, installation of software, trainning of medical personell. The Italian party supplied hardware, hospital equipment and software. The project was financed by the Italian Foreign Ministry.

PERSPECTIVE DOMAINS

- Distributed architectures and appropriate technological solutions
- Mobile applications and related technologies
- Interoperability standards in distributed medical informatics
- Tools for statistical processing of the medical data and for rapid development of embedded applications
- Solutions for integrated healthcare networks and interoperability and for e-administration (document flow and data collecting).

STRATEGIC PRIORITIES

The group intends to develop research, at strategic level, on the directions specified in the domain by the European Community:

- The Education and Training of high level healthcare managers and policy makers on the strategic role of ICT in Healthcare and change management
- To implement programmes on education and training, and other actions to promote awareness and to reduce resistance to change of healthcare professionals
- To set up specific awareness actions addressing sensitive groups, such as: academic circles, high reputation specialists at university hospitals and other local medical opinion leaders, clinical research groups, medicine and nursing students
- To improve mutual learning for the transferring part too, particularly to avoid cultural mismatches.

CONTACT

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Researches in *REAL-TIME CONTROL SYSTEMS*

RESEARCH TEAM

- Prof.dr.eng. Nicolae Robu, head of the team
- Prof.dr.eng. Toma-Leonida Dragomir
- Prof.dr.eng. Gheorghe-Daniel Andreescu
- Assist.eng. Tiberiu Ionică

RESEARCH FIELDS

- Advanced control of AC drives: Sensorless control of IPMSM
- Applications to Electric and Hybrid Vehicles.

KEYWORDS

Sensorless direct torque and flux control; State and disturbance observers; Variable structure flux-observer, Fuzzy-interpolating implementation, Sigmal injection; Real-time implementation; Interior permanent magnet synchronous machines (IPMSM); Electric and hybrid vehicles (EHV).

MAIN ACTIVITIES

➢ Development of Sensorless control system from zero speed for starter-generator with IPMSM for EHV
➢ Development of Integrated sensors of rotor position and speed based on signal injection for IPMSM drives
➢ Real-time implementation and testing using dSpace for Sensorless control system of PMSM drive.

RESULTS

PUBLISHED PAPERS

1. Pitic, C.I., Andreescu, G.D., Blaabjerg, F., Boldea, I., *IPMSM Motion-Sensorless Direct Torque and Flux Control*, 31st Annual Conf. of the IEEE Industrial Electronics Society IECON 2005, Raleigh, NC, USA, Proceedings, Publisher: IEEE, Picataway, NJ, USA, IEEE Cat. No 05CH37699C, ISBN 0-7803-9253-1, ISSN 1553-572X, pp.1756 – 1761

2. Andreescu, G.D., Boldea, I., *Integrated Motion Sensors for Self-Sensing Vector Control of IPM-Synchronous Motors*, Chapter 2 in "Intelligent Systems at the Service of Mankind" (book), Editors: W. Elmenreich, J.T. Machado, I.J. Rudas, vol. 2, Ubooks, Germany, 2005, ISBN 3-86608-052-2, pp. 129 – 140

3. Lascu, C., Andreescu, G.D., *Sliding-Mode Observer and Improved Integrator with DC-Offset Compensation for Flux Estimation in Sensorless Controlled Induction Motors*, IEEE Transactions on Industrial Electronics, ISSN 0278-0046, 8 pages (accepted paper 1853R)

RESEARCH GRANTS AND PROJECTS

National grants and projects
1. Research Grant of the National University Research Council (CNCSIS), no. 143A/2004 phase in 2005: *Sensorless control system from zero speed with direct torque and flux control (DTFC) for starter-generator with IPMSM for EHV (EHV–Sensorless)*, Director: Prof.dr.eng. G.D. Andreescu (granted value for 2005: 22,500 RON)

A prototype of IPMSM at 42 Vdc for EHV has been designed, simulated and manufactured. A new EHV–Sensorless control system has been proposed, including: 1) Development of DTFC with space vector modulation using sliding mode. 2) New rotor position observer with signal injection and phase-sensitive vector- filter including zero speed, with initial position identification. 3) New intelligent observer for flux, torque and speed, starting from zero speed, with combined structure: using signal injection at low speed, and respectively, based on induced voltage at medium-high speed, with a smooth transition. This sensorlees control system has been elaborated and validated by digital simulation. In advance, good preliminary experimental results in complex regimes have been obtained using a dSpace real-time platform within cooperation program between UPT (Prof. Ioan Boldea) and the Institute of Energy Technology, Aalborg University, Denmark (Prof. Fred Blaabjerg). The research results have been published in international journals and conference proceedings as ISI, INSPEC, IEEE papers.

PERSPECTIVE DOMAINS

➢ Real-time control using LabView (LabWindows CVI)
➢ Applications with FPGA using VHDL, Xilinx
➢ Automotive control
➢ Advanced control of electric drives, Robotics.

STRATEGIC PRIORITIES

➢ Control of EHV and Automotive Electric Actuator Technologies
➢ dSpace platform, LabView real-time platform
➢ Advanced control of electric drives, Automotive, Robotics, Mechatronic systems.

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RESEARCH DIVISION IN COMPUTER SCIENCE AND ENGINEERING

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Researches in COMPUTER SYSTEMS ARCHITECTURE

RESEARCH TEAM

➢ Prof. dr. eng. Crişan Strugaru, head of team
➢ Prof. dr. eng. Mircea Stratulat
➢ Prof. dr. eng. Mircea Popa
➢ Lecturer Marius Marcu
➢ Assist. Daniela Stanescu

MAIN ACTIVITIES

- Methods of Temperature and Power Reduction in Embedded Systems and their Applications.
- Development of unconventional computer architectures.
- New interfaces based on image and speech recognition.

PUBLISHED PAPERS

1. Popa, M, Igret, R., Marcu, M., *A Microcontroller Based Smart Home – Internet Connection,* Proceedings of the 3rd IEEE International Conference on Signals, Systems, Devices, SSD'2005, Sousse, Tunis, March 21-24, 2005, ISBN 9973-959-00-0, Full paper SSD05-CSP-121, CD issue, ISBN 9973-959-01-9, pp. 195-196

2. Popa, M., Mihu, L., Macrea, M., *A Tool for Analyzing Assembly Language Projects in Embedded Systems,* Proceedings of EUROCON 2005, the IEEE International Conference on "Computer as a Tool", Belgrade, Serbia and Montenegro, November 21-24, 2005, ISBN 1-4244-0049-X, pp. 603-606

3. Popa, M., Macrea, M., Mihu, L., *Reverse Engineering Analyze for Microcontroller's Assembly Language Projects,* accepted at CISSE'05, the IEEE International Joint Conferences on Computer, Information and System Sciences and Engineering, Bridgeport, USA, December 10-18, 2005 (to be published)

4. Marcu, M., Moldovan, H., Tomescu, V., Zilahi, M., Ionas, M., *Windows XP Issues for Real-Time Temperature Monitoring*, 22nd IEEE Instrumentation and Measurement Technology Conference IMTC2005, Ottawa, Canada, May 2005, ISBN 0-7803-8879-8, pp. 2091-2096

5. Marcu, M., Tomescu, V., Zilahi, M., Ionas, M., *Using Windows NT Based Operating Systems for Real-Time Temperature Monitoring*, 3rd IEEE International Conference on Systems, Signals & Devices, SSD'05, Sousse, Tunisia, March 2005, ISBN 9973-959-00-0, pp. 234-239

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Researches in DISTRIBUTED AND REAL-TIME SYSTEMS

RESEARCH TEAM

- Prof.dr.eng. Ioan Jurcă, head of the team
- Prof.dr.eng. Vladimir Creţu
- Prof.dr.eng. Horia Ciocârlie
- Assist.eng. Carmen Holotescu
- Assist.eng. Sorin Şerău
- Assist.eng. Dan Cosma
- Assist.eng. Stejărel Vereş
- Assist.eng. Adrian Petru Mierluţiu
- Assist.eng. Ciprian-Bogdan Chirilă

MAIN ACTIVITIES

- Programming and distributed processing media.
- Network protocols.
- Designing, implementing and testing real-time executives for systems based on various microprocessors.
- Implementing and testing real-time executives for dedicated applications.
- Extending real-time concepts in distributed applications.
- Integrating Enterprise Applications into GRID-Type Networks Using Service-Oriented Software Architectures.
- Methods, Techniques and Structures for Adaptive Computing Applications in Data Communications Field.

BOOKS

Jurca, I., *Programarea orientata pe obiecte. Limbajul Java,* Ed. de Vest, 2005, ISBN 973-36-0410-0, 311 pages

PUBLISHED PAPERS

1. Ciocarlie, M.S., Ciocarlie, H., *Object Pascal Compiler for Handheld Devices Programming,* Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 5-10

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Researches in *COMPUTER SYSTEMS RELIABILITY*

RESEARCH TEAM

- Prof.dr.eng. Mircea Vladutiu
- Assist.eng. Lucian Prodan
- Assist.eng. Mihai Udrescu

MAIN ACTIVITIES

- Watchdog processor for reliability increasing of computers
- Selftesting development concepts.
- Selfchecking development tools.
- Digital system testing based on data compression (transitions counting syndrome, linear feedback shift register).
- Equipment structures with fault tolerant capability (error detecting and correcting codes, triple modular redundancy).
- Bio-Inspired Design of Applications on Reconfigurable Platforms

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Researches in *DISTRIBUTED DATA BASES AND ARTIFICIAL INTELLIGENCE*

RESEARCH TEAM

- Prof.dr.eng. Ionel Jian
- Prof.dr.eng. Ştefan Holban
- Prof.dr.eng. Marius Crişan
- Lect.dr.eng. Dan Pescaru
- Lect.dr.eng. Sorin Babii
- Lect.dr.eng. Doru Todinca
- Assist.eng. Liliana Jian
- Assist.eng. Cosmin Cernazanu
- Assist.eng. Dan Ciresan

MAIN ACTIVITIES

- Designing and implementing relational databases with complex network structures.
- Pattern recognition in medicine and chemistry.
- Development of a hybrid expert system (rules + neural network) for research in infectious diseases.
- Implementing complex distributed databases and Internet access to databases in companies, banks, and local administration.
- Interdisciplinary cooperation for expert and cognitive systems development.
- E-Learning Application-Oriented Intelligent Agent with Pedagogic Functions.

PUBLISHED PAPERS

1. Mihalas, G.I., Holban, S., Ciresan, D., Cernazanu, C., Simon, Z., Zaharie, D., Kigyosi, A., Neagu, A., Muntean, C., Focsa, M., Lungeanu, D., Neagu, M., *Bio-View – a User-Friendly Interface for Computer Simulations in Systems Biology*, In: Engelbrecht R, Geissbuhler A, Lovis C, Mihalas G (eds), Connecting Medical Informatics and Bio-Informatics, Amsterdam, IOS Press, 2005, pp. 1030-1035

2. Chirila, C.B., Pescaru, D., Tundrea, E., *Foster Class Model*, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence, SACI'2005, Timisoara, Romania, May 12-14, 2005, ISBN 963-7154-39-6, pp. 265-272

3. Ianasi, C., Toma, C., Gui, V., Pescaru, D., *Kernel Selection for Mean Shift Background Tracking in Video Surveillance*, IVth International Conference on Microelectronics, ICMCS-2005, Chisinau, Moldova, September 15-17, 2005, ISBN 9975-66-040-1, pp. 90-94

4. Pescaru, D., Toma, C, Chirila, C., Gui, V., Tundrea, E., *Parameter Transmission Protocol for Grid Image Processing*, IVth International Conference on Microelectronics, ICMCS-2005, Chisinau, Moldova, September 15-17, 2005, ISBN 9975-66-040-1, pp. 79-83

5. Pescaru, D., Ciubotaru, B., Chiciudean, D., Doboli, A., *Experimenting Motion Detection Algorithms for Sensor Network Video Surveillance Applications*, Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64) No. 2, 2005, ISSN 1224-600X, pp. 39-44

6. Chirila, C.B., Crescenzo, P., Lahire, P., Pescaru, D., Tundrea, E., *A Survey on Reverse Inheritance Class Relationship*, Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 45-49

7. Crisan, M., *Towards a Model of Language Understanding*, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence SACI'2005, Timisoara, Romania, May 12-14, 2005, ISBN 963-7154-39-6, pp. 207-220

8. Crisan, M., *Establishing the Information Machine Concept*, Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 55-62

9. Crisan, M., *Explaining Sentence-Meaning in Terms of Differentiated Cognition*, Scientific Bulletin of the „Politehnica" University of

Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 49-54

RESEARCH CONTRACTS

Research contract with Health Ministry: *Biological processes simulation programs with custom interface*, Value: 10.000 RON, 2005, Research team: Prof.dr.eng. Stefan Holban (Head), Cernazean Cosmin, Dan Ciresan

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Researches in *ELECTRICAL MACHINES TESTING AND DIGITAL SIGNAL PROCESSING*

RESEARCH TEAM

- ➢   Prof.dr.eng. Vladimir Creţu
- ➢   Prof.dr.eng. Marius Biriescu
- ➢   Lect.dr.eng. Mihai Micea
- ➢   Lect.dr.eng. Ioana Şora
- ➢   Dr.eng. Gheorghe Madescu
- ➢   Dr.eng. Marţian Moţ
- ➢   Eng. Simion Drăgan

MAIN ACTIVITIES

- ➢   Testing, modeling and monitoring in the domain of electric machines and equipments using data acquisition and processing systems.
- ➢   Design and implementation of digital signal conditioning, acquisition and data processing systems.
- ➢   Data recording and processing programs for transient regime analysis of electrical machines.
- ➢   Optimal design of electrical machines.
- ➢   Virtual instrumentation systems.
- ➢   Modeling, Design and Development of Real-Time Systems for Critical Applications of Data Acquisition, Signal Processing and Embedded Control.

BOOKS

Cretu, V., *Structuri de date şi algoritmi: Structuri de date avansate* (Vol 2), Orizonturi Universitare Publishing House, Timisoara, 2005, 350 pages

PUBLISHED PAPERS

1. Micea, M., Cretu, V., *Highly Predictable Execution Support for Critical Applications with HAERETICK Kernel*, International Journal of Electronics and Communications (AEUE), Vol. 59, No. 5, Elsevier, 2005, ISSN 1434-8411, pp. 278-287

2. Micea, M., Cretu, V., Groza, V., *Maximum Predictability in Signal Interactions with the HARETICK Kernel*, IMTC-05 Special Issue of the IEEE Transactions on Instrumentation & Measurement, (in print)

3. Sora, I., Cretu, V., Verbaeten, P., Berbers, Y., *Managing variability of self-customizable systems through composable components*, Software Process: Improvement and Practice, Vol. 10, Issue 1, January/March 2005, Special Issue on Software Variability: Process and Management, Wiley, ISSN 1077-4866, pp.77-95

4. Sora, I., Todinca, D., Cosma, D., Bobu, G., *Running adaptive software applications over cellular data networks*, Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 33-38

5. Ciubotaru, B., Micea, M., *Routing Protocols and Algorithms in Sensor Networks*, Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 25-32

6. Cioarga, R.D., Micea, M., *Applications of Emergent Behavior Patterns on Intelligent Sensor Networks,* Scientific Bulletin of the „Politehnica" University of Timisoara, Transactions on Automatic Control and Computer Science, Vol. 50(64), No. 2, 2005, ISSN 1224-600X, pp. 15-21

RESEARCH GRANTS AND PROJECTS

1. *Requirement Control System*, Disertation Research Project for Fraunhofer Institute of Manufacturing Engineering and Automation (IPA) Stuttgart, Germany, Head of research team: Prof.dr.eng. Vladimir Cretu

2. *Modeling, design and development of real-time systems for critical embedded applications of signal acquisition, processing and digital control*, Grant CNCSIS, Code 717/2005-7, Theme 7/2005, Value: 20.995 RON, Head of research team: Prof.dr.eng. Vladimir Cretu

3. Research Cooperation Contract with Romanian Academy, *Method for Torque Diagram Determination of High-Power Asynchronous Machines*, No. 1/2005, Nr. BC 294/11.07.05, research member: Prof.dr.eng. Vladimir Cretu

4. *Mediogrid: Distributed and Parallel Graphic Processing on Grid Structure of Environmental Geographical Data*, Subcontract 19-CEEX-

I03-128/07.10.2005, Head of research team: Prof.dr.eng. Vladimir Cretu

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AUTONOMOUS RESEARCH GROUPS

DEPARTMENT OF AUTOMATION AND APPLIED INFORMATICS

MAIN RESEARCH FIELDS

- System theory applications in fault detection and diagnosis
- System analysis using sensitivities
- Development of control system devices
- Fuzzy and neural systems
- Virtual instrumentation in control
- Control of electrical drives

Research group in *APPLIED SYSTEMS THEORY*

RESEARCH TEAM

- Prof.dr.eng. Toma-Leonida Dragomir, head of the team
- Assoc.prof.dr.eng. Constantin Voloşencu
- Lecturer dr. eng. Dorina Popescu
- Lecturer dr. eng. Sorin Nanu
- Assist. eng. Ana Maria Dan
- PhD Student eng. Adrian Korodi

MAIN RESEARCH FIELDS

- System theory applications in fault detection and diagnosis
- System analysis using sensitivities
- Development of control system devices
- Fuzzy and neural systems
- Virtual instrumentation in control
- Control of electrical drives

KEYWORDS

Fault detection, identification and diagnosis, modelling, system safety and availability, controller design, process control, interpolating strategies, fuzzy logic, neural networks, control of electrical drives, virtual instruments.

RESULTS

RESEARCH GRANTS AND PROJECTS

1. CNCSIS Grant, No. 309/33062, Research theme in cooperation with the University of Craiova, *The development of automated structures for increase the dependability of the control systems with applications in industrial systems (energetics, chemistry, aviation, robotics)*, 2004 (continued in 2005)

2. CNCSIS Grant, Code 205, theme no. 25, contract no. 32940/22.06.2004 (continued in 2005), *Researches to implement strategies based on fuzzy logic and neural networks for fault detection and diagnosis, with application at the electrical drives*, Director: Assoc. prof. dr. eng. Constantin Voloşencu

BOOKS

1. Popescu, D., Nanu, S., Voloşencu, C., Peană, L., Dan, A.M., Dragomir, T.L., *System Theory - Applications 1*, Politehnica Publishing House, 2005, ISBN 973-625-010-5, 128 pages

2. Dragomir, T.L., *System Theory - Applications 2*, Politehnica Publishing House, 2005, ISBN 973-625-233-7, 204 pages

PAPERS

1. Korodi, A., Voloşencu, C., *M-N-K Hybrid Type Redundancy Applied on an Electrical Drive*, EDS IMAPS CS 2005, Brno, Czech Republic, 2005, Proceedings, 6 pages

2. Voloşencu, C., *Detecţia şi diagnosticarea defectelor sistemelor de conducere a acţionărilor electrice bazată pe reţele neuronale,* 8th International Conference on

Engineering of Modern Electric Systems EMES'05, Oradea, 2005, Proceedings, ISBN 963-7154-26-4, pp. 39-44

3. Voloşencu, C., *Detecţia şi diagnosticarea cu reţele neuronale a defectelor unui sistem de reglare a turaţiei unui motor sincron cu magneţi permanenţi,* 8th International Conference on Engineering of Modern Electric Systems EMES'05, Oradea, 24-25 May 2004, Proceedings, ISBN 963-7154-26-4, pp. 29-38

4. Vladu, E.,Dragomir, T.L., On Data Management in Elementary System Identification Approaches Using Genetic Algorithms, IEEE International Workshop on Soft Computing Applications, IEEE-SOFA 2005, Szeged-Hungary & Arad-Romania, ISBN 963 219 001 7, 200**5**, pp. 85-92.

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Research group in *PROCESS CONTROL*

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➢ Assist.eng. Emil Voişan
➢ PHD student Dan Alexandru
➢ PHD student Daniel Iercan

RESEARCH FIELDS

➢ Chaotic systems
➢ Programmable Logic Controllers
➢ Remote control
➢ Operating Systems
➢ Real-time Programming

KEYWORDS

Chaotic systems, programmable logic controllers, remote control.

ACTIVITIES

➢ camera virtual with COIN 3D
➢ haptic device control
➢ analysis and synthesis of the electronic converters with chaotic behaviour

PUBLISHED PAPERS

1. Drăgan, F., *Intermittency in a Chaotic Current Mode Controlled Boost Converter*, International Carpathian Control Conference ICCC'2005, Miskolc-Lillafured, Hungary,

Proceedings, Editors: T. Adam, P. Serfozo, A.K. Varga, J. Vasarhelyi, ISBN 963-661-644-2, vol. II, 2005, pp. 275 – 279

2. Voisan, E., Iercan, D., Drăgan, F., *Aspects of a Virtual Room Construction Using Open Inventor/Coin3D Technology*, International Carpathian Control Conference ICCC'2005, Miskolc-Lillafured, Hungary, Proceedings, Editors: T. Adam, P. Serfozo, A.K. Varga, J. Vasarhelyi, ISBN 963-661-644-2, vol. II, 2005, pp. 409-414

STRATEGIC PRIORITIES

➢ Control of chaotic systems
➢ Remote control

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Research group in *KNOWLEDGE ENGINEERING. APPLICATIONS IN MEDICINE*

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➢ Lecturer dr. eng. Dorina Petrică, head of the team
➢ Assist.eng. Lavinia Dragomir
➢ Assist.eng. Raul Robu
➢ Eng. Bogdan Groza, PhD student

RESEARCH FIELDS

➢ Knowledge based systems
➢ Artificial intelligence
➢ Medical expert systems
➢ Cryptographic techniques, security.

KEYWORDS

Inference strategies, knowledge representation and processing, neural networks, medical diagnosis and decision-making process, entity authentication, applied cryptography

ACTIVITIES

➢ Development of medical expert systems and other applications for medical diagnosis
➢ Authentication protocols

PUBLISHED PAPERS

1. Groza, B., Petrică, D., *One time passwords for uncertain number of authentications,* CSCS-15, 15th International Conference on control systems and computer science, 25-27 May 2005, Politehnica University of Bucharest, Proceedings, 6 pages

2. Groza, B., Petrica, D., Dragomir, T.L., *A Time- memory Trade Solution to generate One-time Passwords using Quadratic Residues over Z_n*, Studies in Informatics

Control, Edited by the National Institute for R&D in Informatics ICI Bucharest, ISSN 1220-1766, pp. 201- 212

3. Groza, B., Petrica, D., *Cryptanalysis of an Authentication Protocol*, SYNASC'05, 7th Symposium on Symbolic and Numeric Algorithms for Scientific Computing, Sept. 25-29, 2005, Timisoara, IeAT Technical Report 05-06, pp. 114-120

4. Groza, B., Petrica, D., Dragomir, T.L., *Security based on cryptographic techniques for remote contril systems*, SINTES, XII International Symposium on System Theory, Oct. 20-22, 2005, Craiova, Proceedings, Vol 4 Computer Engineering, ISBN 973-742-148-5, 973-742-154-X, pp. 729-734

PERSPECTIVE DOMAINS

➢ The use of artificial intelligence methods for medical diagnosis.
➢ Building rules-based medical expert systems.
➢ Security based on crypthographic techniques protocols.

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DEPARTMENT OF COMPUTERS
Research group in *OBJECT-ORIENTED SOFTWARE ENGINEERING*

RESEARCH TEAM

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➢ Assist.eng. Călin Jebeleanu
➢ Assist.eng. Cristina Marinescu
➢ Assist.eng. Petru Florin Mihancea

RESEARCH FIELDS

➢ Evolution and re-engineering of object-oriented software systems
➢ Software quality assurance
➢ Analysis and formal vcrification of software

KEYWORDS

Object-oriented software evolution, re-engineering, design faults, detection strategies, quality metrics, quality assurance, analysis tools, formal verification

BOOKS

Clarke, E., Minea, M., Tiplea, F.L., *Verification of Infinite-State Systems with Applications to Security*, IOS Press, 2005, ISBN 1-58603-570-3, 244 pages

PUBLISHED PAPERS

1. Elmquist, J., Nadjm-Tehrani, S., Minea, M., *Safety Interfaces for Component-Based Systems,* Proc. International Conference on Computer Safety, Reliability and Security, Springer LNCS 3688, 2005, pp. 246-260

2. Beauquier, D., Duflot, M., Minea, M., *A probabilistic property-specific approach to information flow*, Proc. Mathematical Methods, Models and Architectures for Computer Networks Security, Springer LNCS 3685, 2005, pp. 206-220

3. Jebelean, C., *A study on detecting refactoring opportunities to introduce the abstract factory design pattern in object-oriented code*, 2nd Romanian-Hungarian Joint Symposium on Applied Computational Intelligence, SACI 2005, Timisoara, Romania, ISBN 963-7154-39-6, pp. 381 - 389

RESEARCH CONTRACTS

1. *Modeles executables et verifiables pour la securite des systemes communicantes*, Grant ECO-NET, No. 08112WJ, 2004-2005, Romanian partner: Assoc.prof.dr.eng. Marius Minea, Value for 2005: 20.000 EUR

2. *ARTIST2: Embedded System Design*, IST-004527, Romanian partner: Assoc.prof.dr.eng. Marius Minea

3. *Integrated Evolving Platform for Sofware Systems Analysis*, CNCSIS contract No. 27688 / 14.03.2005, Theme 19,Value: 25.000 RON, Director: Radu Marinescu. Research team: Marius Minea, Dan Pescaru, Ioana Sora, Cristina Marinescu, Petru Florin Mihancea.

4. *Network of Reengineering Expertise – NOREX*, Contract with Swiss National Science Foundation (SNSF), SCOPES project, Value for 2005: 12.100 EUR, Director: Radu Marinescu, Research team: Cristina Marinescu, Petru Florin Mihancea

5. *Measures to ensure quality of design in industrial software systems*, CEEX Project No. 3147, 2005, Ministry of Education and Research, Value for 2005: 20.000 RON, Director: Radu Marinescu, Research team: Dan Pescaru, Ioana Sora, Cristina Marinescu, Petru Florin Mihancea, Calin Jebeleanu.

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