AUTOMATION 2012

March 21 - 23, 2012 - Industrial Institute for Automation and Measurements PIAP.
3 plenary papers and 84 regular papers covering six topic area.
Bellow name of the sessions and title of the papers with abstracts

PLENARY SESSION
1.
Wolfgang A. Halang, Prof. Dr.,
Chair of Computer Engineering, Fernuniversität, Hagen
Quality of Automation
As manufacturing and logistics processes have a significant impact on the quality of products and services, the quality of the automation involved should be considered as well. To this end, a list of quality criteria for automating systems is proposed, consisting of qualitative exclusive, qualitative gradual and of quantitative criteria. It is shown that qualitative characteristics are much more important than quantitative ones. Provided that they fulfill the exclusive criteria, automating systems may then be compared on the basis of the gradual and quantitative ones. Since quality of automation also depends on the quality of the corresponding engineering processes, some criteria are compiled to evaluate the quality of automating, and critical points of technological regress in the design and development processes of automation systems are identified. Finally, the quality of automation as such is addressed and several requirements for it mentioned. It is indicated that automation may not always be useful, and that it can turn out harmful to society.

2.
prof. dr hab. inż. Adam Borkowski
Polaka Akademia Nauk
Mobile Robotics– reactivation
The aim of this lecture is to assess critically the state-of-art in Mobile Robotics. It seems to be obvious that this dynamically developing domain reached at present a potential of breakthrough in applications. In order to achieve such breakthrough, certain routine research patterns should be modified and the whole volume of research achievements should be evaluated against practical applicability. The main sub-domains of Mobile Robotics – localization, mapping, path planning and planning at utility level – will be analyzed this way.

3.
prof. dr hab. inż.Józef Korbicz
University of Zielona Góra, Institute of Control and Computation Engineering
Fault diagnosis of dynamical processes: A soft computing approach
The development of new fault diagnosis methods and techniques is forced by the increasing complexity and reliability demands of contemporary industrial systems. The main objective of this survey paper is to present recent developments in modern fault diagnosis of dynamical systems with soft computing techniques. The concept of a model-based approach to fault diagnosis is considered. Special emphasis is put on the problems of robust fault detection in process diagnosis with soft computing techniques such as neural networks (Group Method of Data Handing, GMDH), neuro-fuzzy networks (Takagi-Sugeno model) and evolutionary algorithms. The neural-network-based approach is attractive for settling the fault diagnosis

problem when the mathematical model is unavailable or too complex. The so-called bounded error approach is applied for defining soft computing models' uncertainty, i.e., for GMDH networks and Takagi-Sugeno fuzzy models. Finally, some of the presented techniques are illustrated using DC motor and tunnel furnace fault diagnosis.

SESSION I - AUTOMATION, ROBOTICS, MONITORING

4.

dr hab. inż. Jan Studziński
Instytut Badań Systemowych PAN

Planning the monitoring systems supporting the communal water nets management

In the paper an algorithm for planning the monitoring systems for communal water networks is described. This special planning enables designing the monitoring systems that make possible to support the water networks management and especially the operational control and planning of water nets. The exemplary tasks that can be solved using the monitoring systems properly planed are the finding out the hidden water leaks on the water net [5] and automatic calibration of the water net hydraulic model.

5.

dr inż. Artur Wieczyński, mgr inż. Arkadiusz Perski, Maria Baczyńska
Przemysłowy Instytut Automatyki i Pomiarów PIAP

An innovative satellite project for elevation of travel safety and comfort in the European Transport Corridors

The article gives a description of the innovative project utilizing satellite technologies that is being carried out by PIAP. The project objective is to design and implement of a system for use in the European Transport Corridors. The new W2A satellite will enable a bi-directional satellite communication with vehicles around Europe. The software applications designed will increase safety and comfort of travelling while helping to reduce travel costs and emission of exhausts.

6.

dr inż. Grzegorz Bocewicz*, prof. dr hab. inż. Zbigniew Banaszak**
*Technical University of Koszalin, **Warsaw University of Technology

Scheduling for Multi-modal Cyclic Transport Systems

This paper concerns the domain of the multimodal transportation systems composed of buses, trains, trams and subways lines and focuses on the scheduling problems encountered in these systems. Transportation Network Infrastructure (TNI) can be modeled as a network of lines providing cyclic routes for particular kinds of streamlike moving transportation means. Lines are connected by common shared change stations. Depending on TNI timetabling the time of the trip of passengers following different itineraries may dramatically differ, e.g. the same distances along the north-south, and east-west directions may require different travel time. So, the mine question regards of TNI schedulability, e.g. the guarantee the same distances in arbitrarily assumed directions will require approximate traveled time. Considered timetabling problem belongs to NP-hard ones. The declarative model of TNI enabling to formulate cyclic scheduling problem in terms of the constraint satisfaction one is our main contribution. At last, the simulated results manifest the promising properties of the proposed model.

7.

mgr inż. Michał Smater, mgr inż. Sławomir Puchalski

Przemysłowy Instytut Automatyki i Pomiarów PIAP
Holistic approach for Quality in manufacturing SME
Today's situation on the European market, rising global competition along with the world economic crisis and the cost pressure resulting out of it, forces SMEs to put more efforts to increase their competitiveness. One of the possibilities is the improvement of the production process quality, which allows to manufacture products of the highest quality while keeping production costs on the competitive and reasonable level. Particularly advanced Ambiance Intelligence (AmI) technology offers excellent opportunities to improve process quality in SMEs. This would allow those companies not only to survive on the demanding market, but also to develop and build solid relations with customers and other companies which need sub suppliers of the highest quality.

8.

mgr inż. Mariusz Kowalski*, dr inż. Mariusz Sosnowski**
*Bernecker & Rainer, Austria, ** Zachodniopomorski Uniwersytet Technologiczny w Szczecinie
**Construction, control system and software of automated position
with complex kinematics**
The paper presents the design, control system and software that controls automated the position of complex kinematics. Control interface and software is developed and manufactured in the West Pomeranian University of Technology in Szczecin in the Department of Automated Manufacturing Systems Engineering and Quality. Conducting classes designed to teach programming and design of structures and systems for monitoring the robot kinematic components with unusual structures was the reason for installation of the control system and software.

9.

**mgr inż. Jacek Zieliński, mgr inż. Marcin Słowikowski, mgr inż. Sławomir Puchalski,
mgr inż. Zbigniew Pilat**
Przemysłowy Instytut Automatyki i Pomiarów PIAP
Possibility of implementing intelligent welding system supervision using ICT solutions and WEB 2.0 services
Equipment used for the construction of robotic manufacturing cells are now commonly equipped with intelligent control. It not only enables efficient exchange of information with other components of the system but also allows to implement a very efficient hardware and software diagnostic tools. Operators and technologists gain the ability to monitor the status of these devices, as well as the process. The use of communication controllers and connecting devices to the global network enables the realization of this monitoring in remote mode. Its effectiveness can be increased by the use of modern ICT solutions. The article presents apractical example of implementation of remote monitoring of the welding system with the use of WEB 2.0 services.

10.

**prof. dr hab. inż. Jerzy Kurek, prof. nzw. dr hab. inż. Roman Szewczyk,
dr inż. Jacek Salach, mgr inż. Rafał Kłoda**
Politechnika Warszawska
Control of Resistive Furnace for Annealing of Amorphous Alloys
Paper presents theoretical and practical aspects of automated control of resistive furnace for thermal annealing of magnetic cores made of amorphous alloys. Process of annealing requires

specific conditions both from the point of view of temperature and its changes. Solutions presented in the paper creates possibility of both low value of error as well as fast achievement of set value.

11.
dr inż. Piotr Kuryło*, inż. Mateusz Nagórny**
*Uniwersytet Zielonogórski, **Linstal Sp. z o.o.
Some Problems of Automation and Robotization of Welding Process in the Large Size Constructions
In the study the selected, technological problems of container steel structure manufacturing are presented. Possibility of application of the industrial robots in automation of welding the trapezoidal sheet metal in container plating is discussed.

12.
dr inż. Paweł Sitek, dr inż. Jarosław Wikarek
Politechnika Świętokrzyska
Mathematical model of optimization in supply chain
The article presents the author's model of supply chain optimization in terms of logistics operator. The model was formulated as an integer linear programming problem with objective function specifies the cost of a distributor, manufacturer, and transportation. A detailed discussion of the discussion of model constraints, parameters and decision variables. In addition, the article presents the current state of logistics outsourcing.

13.
dr inż. Paweł Sitek, dr inż. Jarosław Wikarek
Politechnika Świętokrzyska
Optimization of costs in supply chain – mathematical model implementation
The paper presents the implementation of the supply chain cost optimization model. The model was formulated as a linear integer programming problem with objective function specifies the cost of distribution, manufacturing and transportation. Implementation took place in an environment optimization package "LINGO". After the implementation the computational experiments were carried out for sample data sets.

14.
dr inż. Piotr Penkała
Politechnika Lubelska
Use of CAD/CAM systems in the process of production preparation
Using software such as CAD/CAM systems, designer can simulate the process technology and designed to validate the process in virtual reality. You can control the collision with the workpiece material, tool and machine tool. With this type of testing is not destroyed expensive equipment and tools. In case the computer simulation results are satisfactory returns to the reality of production. Some programs such as CAD/CAM by the fact that the technological parameters formulate proposals and other suggestions – such as the type of surface analysis and selection of optimal tools – programs act as expert.

15.
mgr inż. Jacek Pękala, Konrad Gadzina

Politechnika Krakowska
Data transformation from native structure to B2MML format as part of systems integration
This paper is an attempt to bring closer the issues of data exchange between different subjects of enterprises IT structure which is the essence of their integration. The paper focuses primarily on transformation of data swapped between systems. The article presents a design concept of solution for data transformation and its structure. Its operability was tested on sample data generated by the IFS – exemplary ERP system.

16.
prof. nzw. dr hab. inż. Jerzy Zając, mgr inż. Kamila Norys
Politechnika Krakowska
Examining the process of manufacturing control system self configuration
The paper describes the modeling process of a discrete manufacturing system as a three-stage procedure. It also presents the self configuration procedure for distributed manufacturing control system. It will allow for the construction of the plug and produce distributed manufacturing control system, which require the integration of unified, easy to reconfigure, intelligent and cooperative agents. Arena Simulation Environment (Rockwell Automation) is used for examining the procedure.

17.
dr hab. inż. Dariusz Plinta, dr inż. Izabela Kutshenreiter-Praszkiewicz
Akademia Techniczno-Humanistyczna w Bielsku-Białej
The use of experts systems in process production planning
The paper presents application of expert systems in the planning of production process. The aim of planning is to determine the possible terms of orders and the sequence of execution of production orders. Taking into account all factors influencing decisions, which are related to planning processes, it becomes impossible without the use of methods and tools for decision support, for example expert systems with methods presented in this paper – with QFD, modeling and simulation.

18.
dr inż. Justyna Patalas-Maliszewska
University of Zielona Góra, Poland/Vienna University of Technology, Austria
The author's software system for planning and selection of personnel in SME
he strategic management of intellectual capital involves rethinking how the companies creates value from a knowledge-centric perspective and redesigning and orchestrating the role of staff knowledge in the firm's strategy. This paper presents the author's software system for facilitating decision making at a strategic level in terms of the profitability of investment in staff knowledge. This software is a computer implementation of the method for planning and selection of personnel in SME.

19.
prof. dr inż. Tadeusz Missala
Przemysłowy Instytut Automatyki i Pomiarów PIAP
New functional safety standardization Works – result of the technological progress

There are characterized amendments introduced during last 5 years to standards concerning functional safety: Basic series IEC 61508, programmable controllers, communication networks and electromagnetic compatibility requirements.

20.

mgr inż. Wojciech J. Klimasara, mgr inż. Jacek Zieliński, mgr inż. Marcin Słowikowski, mgr inż. Zbigniew Pilat
Przemysłowy Instytut Automatyki i Pomiarów PIAP

Modern trainings in field of safety in automatized and robotized installations using advanced information technology solutions

This article shows new approach to design of OHS training materials witch utilization dedicated ICT solutions, application of European Credit Transfer System for Vocational Education and Training – ECVET and European Quality Assurance Reference Framework/ European quality assurance in vocational education and training) EQARF/EQAVET.

21.

dr inż. Andrzej Grabowski
Centralny Instytut Ochrony Pracy – Państwowy Instytut Badawczy

The use of open source software for the 3D reconstruction of work places

Vision systems are used for many years to reconstruct the 3D objects of various types. Usually, however, their use is associated with certain limitations, e.g. size of the scanned object or lighting conditions. This paper presents a universal and low-cost method of 3D reconstruction of work places based on open source software such as OpenCV and PCL (Points Cloud Library). The developed method gives high accuracy of reconstruction, can be used for both small and large objects, and is largely independent of ambient light – works indoors and outdoors. Presented method will be used for 3D reconstruction of the work places in order to test the video based safety systems with the help of mixed reality techniques.

22.

mgr inż. Paweł Budziszewski
Centralny Instytut Ochrony Pracy – Państwowy Instytut Badawczy

Kinect and inertial sensor based motion capture system for virtual reality and remote control tasks

This paper describes the method of using Microsoft Kinect controller and a set of inertial and magnetic sensors for recording human movement for virtual reality applications. Positions of the head and hands are recorded using the Kinect controller. Inertial system is used to record the rotation. It is calculated on the basis of the gyroscope. Accelerometer and magnetometer are used to determine the initial position and compensation of gyroscope errors.

23.

mgr inż. Marcin Milanowicz, mgr inż. Paweł Budziszewski
Centralny Instytut Ochrony Pracy – Państwowy Instytut Badawczy

Computer model of human upper extremity moving by simulated muscles

Computer human models are used for many years to carry out numerical simulations that describe the various types of phenomena and events. However, their use is often associated with certain limitations such as inability to simulate human behavior resulting from muscle tension. This paper presents the developed model of the upper extremity moving by simulated muscles

controlled using a PID controller. Model of the limb moves in two degrees of freedom allowing the flexion and extension of the forearm and its supination and pronation. The model was developed using MADYMO software, which is used to conduct numerical simulations, and then implemented to the the pedestrian model available in the MADYMO database.

24.
mgr inż. Antoni Kopyt, dr inż. Robert Głębocki
Politechnika Warszawska
Human model identifiacation
The aim of this paper was to identify a human operator as a system in Man-Machine system. A tracking task was used to collect all necessary data. Human operator using a joystick was to track the given signal with different frequencies. A tracking task was written in MATLAB/ Simulink, with Real-Time workshop modul. For the purposes of identification the System Identification Toolbox was used. This work presents a range of frequencies within the human can perform. A final product of the experiment is one human model. The final coefficients was obtained from earlier approximation, based on data from experiment. Presented model can be used in further study concerning the experiments of man-machine systems.

25.
dr inż. Daniel Reclik, mgr inż. Paweł Kaczmarczyk
Politechnika Śląska
Application of microprocessor measurement system for rotation measuring phantom construction for generating programs of FANUC ARCMate 100iB robots
The main goal of this work is to present the project and method for realization of microprocessor measurement system for measuring total angle position of rotary potentiometer. The presented solution is installed in FANUC ARCMate 100iB manufacturing robot, which is created by usage of fast prototyping methods. The main assumption of the presented work was to use phantom for determining the suitable kinematic chain positions of the robot. It is realized by pointing the position by the usage of manually moved robot model. To make robot programming possible, in this case, it was needed to fulfill the two main assumptions. First of all, the full model scaling was necessary, which means to keep the corresponding dimension proportion regarded to normal manufacturing robot. Second of all, we had to applied the suitable measuring system for measuring the angle position of following kinematic chain elements of phantom. The results show that, the precision in determining the indirect positions of robot trajectory mainly depend on accuracy of methods for measuring the angle rotation of phantom arms. Moreover, the calculations carried out that, the precision of angle rotation measurements must be higher than the quality of real mechanical model.

26.
dr hab. inż. Gabriel Kost, prof. PŚl, dr inż. Daniel Reclik
Politechnika Śląska
The modern, cinema techniques of the 3D pictures displaying in didactic process in the skill of selection principles and way of working of the industrial robots manipulation equipment
In 2009 on Faculty of Mechanical Engineering in Silesian Technical University in Gliwice there has been introduced the innovative system for presenting the educational contents by the usage of modern techniques of 3D pictures projection. All the educational contents are connected with the subjects leaded on the faculty. In this paper there is presented the selection principles and way of

working of the industrial robots manipulation equipment. In the INTEREDU project[3] there was prepared additional educational contents for basic subjects, as well as for subjects like robotics and technological processes robotization. The worked out educational contents allow on enlarging the didactic offer and new branch of study on the faculty. Moreover, the usage of modern techniques for education has also positive effects on range of students knowledge. This paper presents the range and possibilities of worked out interactive educational contents, which allow on showing the structure and way of working of typical tools used for objects manipulation in robot integrated manufacturing systems. Additionally, taking advantage of virtual reality, there is also prepared the special mechanism which allows on interactive camera steering, as well as robots steering, during lecture displaying. This solution in connection with the possibility of creating the view sections allow on showing the way of working of the typical mechanical systems used in manufacturing robots. Regarded to above solutions, there is possible to present things unable to see during conventional lectures, e.g. way of working of the automatic gripper changing system with removed case (it is impossible in real adapter because the drive cylinder would be depressurize). All above things have a great influence on the higher educational quality. That's the reason why the authors have decided to prepare this paper. All we also hope that the interactive educational contents will be introduced in other research centers in our country.

27.
dr inż. Daniel Reclik, dr inż. Wacław Banaś, mgr inż. Andrzej Nierychlok
Politechnika Śląska
The modern cinema techniques of the 3D pictures displaying in didactic process in the skill of building and way of working of the industrial robots' drives and motors
In 2009 on Faculty of Mechanical Engineering in Silesian Technical University in Gliwice there has been introduced the INTEREDU [4] innovative system for presenting the educational contents by the usage of modern techniques of 3D pictures projection [1–3]. In this project there was worked out additional educational contents for ba**80** sic and major subjects leaded in our university, e.g. robotics, robot's programming, design of tools and tooling, etc. This paper presents the range and opportunities of worked out interactive educational contents, which allow on showing the structure and way of working of typical electrical, pneumatic and electro-hydraulic drives with gears applied in manufacturing robots and additional components, which are commonly used in robot integrated manufacturing systems. The project allows on enlarging the didactic offer of the Faculty of Mechanical Engineering, what has a great influence on enlarging the students knowledge and their future successes at work in the industry. Moreover, taking advantage of virtual reality [1–4], there is also prepared the special mechanism which allows on interactive camera steering, as well as objects steering, e.g. chain gear. Furthermore, it is possible to choose the special mode where the case is invisible just to see how everything is working inside. This brand new system of pictures displaying, which was used so far in cinemas, allows on better relaying the technical and engineering news to students. All above things have a great influence on the higher educational quality. That's the main reason why the authors have decided to prepare this paper. Besides, we believe that the interactive educational contents will be introduced in other research centers in our country someday.

28.
mgr inż. Rafał Chojecki, dr hab. Barbara Siemiątkowska, dr inż. Jakub Michalski,
mgr inż. Michał Walecki, mgr inż. Mateusz Wiśniowski
Materials Engineers Group Sp. z o.o.

Non Destructive Mobile Robot System for Testing of Weld Joints
This paper describes research towards the development of a robotic system for the automated welded joints testing. The tests are often carried out manually by skilled personnel. Automating the inspection process would reduce errors and associated costs. The system proposed in this paper is based on a mobile robot platform and is designed to carry ultrasonic sensors in order to scan welds for defects. The robot is equipped with vision system in order to detect the weld position. The fuzzy control system is used in order to control robot motion along the weld.

SESSION II - MOBILE ROBOTS SOFTWARE, EQUIPMENT AND APPLICATION
29.
Tomasz Liecau, Michał Warkocz, Krzysztof Wąsik, dr inż. Michał Grochowski
Politechnika Gdańska
Modeling, control and visualisation of a quadrocopter
The paper presents an approach for building a mathematical model of a quadrocopter. The main objective was to design the appropriate quadrocopter control and analysis of its behavior in different situations. As the assumption was that the model, control system and all the accompanying algorithms have to be realized in an open source and free programs, to allow for their later implementationin plant, without the need for expensive software. Quadrocopter control by the operator is carried outusing hand movements read by the camera and then properly interpreter with the great help of advanced methods of image processing techniques. The whole system is visualized and embedded in three-dimensional simulation environment.

30.
inż. Patryk Pipczyński, dr inż. Robert Piotrowski
Politechnika Gdańska
Technical design and construction of two-wheeled self-balancing mobile vehicle
In recent years we can see rapid development of mobile vehicles that are becoming more widely used in everyday life and in different industries. The paper presents the design assumptions and structure of two-wheel self-balancing mobile vehicle. Then it describes in detail the mechanical construction, electronic and measuring devices. The individual components are designed, chosen and combined to form a coherent whole.

31.
mgr inż. Marek Matuszak, dr hab. inż. Piotr Skrzypczyński
Politechnika Poznańska
An educational quadruped robot with hybryd leg-wheel locomotion
This paper considers the issues of design and implementation of mechanics, control system and software of a quadruped walking robot. The robot has a hybrid leg-wheel locomotion mechanism, which makes it an interesting subject for studies in robot control and motion planning. The design of the robot's hardware is shown in details, followed by a presentation of the implemented motion strategies, which involve both the legged (discrete) and the wheeled (continuous) modes of locomotion. Results are presented also on movie clips, ahich are made available in the Internet.

32.
mgr inż. Jakub Bartoszek
Przemysłowy Instytut Automatyki i Pomiarów PIAP
Robosnake – New Trend In Mobile Robotics

This elaborations covers an issue of motion control, of serial mobile robot. Design and kinematic diagram of the robot are modeled on the morphology of the snake. The first part discusses the reasons for this research topic. The second section lists the known structures on which the control algorithms has been developed. The method of the division of these structures have been explained. In the third part, concerning the control algorithms, has been described the overall structure of the snake and its way of moving. Also the four main snakes locomotion methods has been described due to their motion capabilities and possibilities of implementation. Further in this chapter the proposed control algorithm is being discussed. The results of simulation and mechanical design are presented.

33.

mgr inż. Maciej Cader
Przemysłowy Instytut Automatyki i Pomiarów PIAP

The prototype of the climbing platform dedicated for inspection of the power boiler's walls

Nowadays, diagnostics of high-energy boilers' walls is carried out mainly from scaffoldings. Servicemen carry out manual measurements of the use of the boiler in selected points, which can be up to 20 thousand. In response to the current method of measuring the Industrial Research Institute for Automation and Measurements is working on a prototype system for automated diagnostic of boilers' walls. The system consists of the climbing robot, control console and software for control and processing data obtained by the robot. This article presents the results of work of engineers from the Institute, the results of studies and the first tests of the system.

34.

mgr inż. Jarosław Jankowski
Centralny Instytut Ochrony Pracy – Państwowy Instytut Badawczy

The use of virtual reality techniques for teleoperation of mobile robot

Nowadays robots are widely used to replace human in monotonous works which movements can be programmed. However, there are tasks that have to be performed in unknown and hazardous environments. In such cases it is reasonable to use teleoperation, i.e. to operate a machine from a distance. Implementation of visual feedback by the monoscopic presentation of images taken from cameras, which are mostly stationary placed on a robot's manipulator, introduces difficulties in controlling and limits operator's spatial perception. These defects can be minimized by using virtual reality technology. The use of stereoscopic visualization and head-mounted display (HMD) may provide higher perception of environment depth that can increase precision of manipulation. Data gloves and system tracking used for registration movement of hand and head allow to create more intuitive control interface. The paper presents a construction of a functional model of a mobile robot, which will be used to conduct a study aimed at comparing the three types of human-robot interfaces.

35.

dr inż. Szczepan Paszkiel, mgr inż. Andrzej Błachowicz
Politechnika Opolska

The use of BCI for controlling the mobile robot

The article presents the practical use of brain-computer interface in the process of controlling a multi-role mobile robot constructed on one's own. Emotiv EPOC Neuroheadset is used during the laboratory research. The acquisition of the signal occurs by placing active electrodes on the head of a subject. Then the signal is processed and used for controlling the mobile robot.

36.
Janusz Będkowski, PhD*, Geert De Cubber, PhD**, Andrzej Masłowski, PhD, Full Prof.*
*Politechnika Warszawska, **Royal Military Academy, Brussels, Belgium
6D SLAM with GPGPU computation
The main goal was to improve a state of the art 6D SLAM algorithm with a new GPGPU-based implementation of data registration module. Data registration is based on ICP (Iterative Closest Point) algorithm that is fully implemented in the GPU with NVIDIA FERMI architecture. In our research we focus on mobile robot inspection intervention systems applicable in hazardous environments. The goal is to deliver a complete system capable of being used in real life. In this paper we demonstrate our achievements in the field of on line robot localization and mapping. We demonstrated an experiment in real large environment. We compared two strategies of data alignment – simple ICP and ICP using so called meta scan.

37.
dr hab. Barbara Siemiątkowska, mgr inż. Rafał Chojecki, mgr inż. Monika Różańska-Walczuk, mgr inż. Maciej Przybylski, mgr inż. Piotr Węclewski, mgr inż. Mateusz Wiśniowski
Politechnika Warszawska
Path planning in a dynamic environment based on CNN
The control of mobile robot is a fundamental and basic task. Nowadays, the most actual trends focus on autonomous control systems. This paper describes a scientific project, which main goal is fully autonomous navigation system, designed for new construction of mobile robot. Final stage of the project is real application. The significant problem of robot navigation is path planning, especially when mobile platform is predestinated to be used in a real environment enclosed with dynamic obstacles. Dynamic objects should be considered in the path planning algorithm. The navigation system of mobile robot, moving among people, should response with short reaction time for fast environment changes. In this paper authors present parallel computing implementation, in this case – with use of graphic processors (GPU).

38.
mgr inż. Rafał Chojecki, dr inż. Jakub Michalski, mgr inż. Michał Walęcki,
mgr inż. Mateusz Wiśniowski
Materials Engineers Group Sp. z o.o.
All terrain mobile platform RoMegAT
This paper describes research towards electric mobile platform in two variants: 4×4 or 2×3. This class of robots could be used in autonomous patroling applications, remote visual inspection of industrial areas, helping rescue or anti-terrorists groups. Described mobile platform is designed for indoor and outdoor environment. Unique construction enables traversing terrain obstacles.

SESSION III - DESIGN AND INTEGRATION METHODS FOR SYSTEMS
39.
prof. dr hab. inż. Mikołaj Busłowicz, mgr inż. Tomasz Juchimowicz
Politechnika Białostocka
Stability analysis of oscillatory system with PD controller of fractional order
The problem of stability of linear continuous–time control system consisting of oscillatory plant and fractional order PD controller is considered. Methods for stability investigation is such

systems and determination of stability region in the plane of controller parameters are given. The considerations are illustrated by numerical examples.

40.
prof. dr hab. inż. Mikołaj Busłowicz, mgr inż. Artur Eryk Rzepecki
Politechnika Białostocka
Computer methods for stability investigation of the Roesser model of 2D linear systems
The problem of asymptotic stability of linear dynamic 2D systems is considered. Computer methods for asymptotic stability analysis of the Roesser model in the general case and analytic method in the case of scalar systems are given. The considerations are illustrated by numerical examples.

41.
prof. dr hab. inż. Mikołaj Busłowicz
Politechnika Białostocka
Analysis of the Lorenz system of fractional order
Generalization of the state equations of the classical Lorenz chaotic system to case of the system with the same fractional order of all state variables is given. It has been proved that the fractional Lorenz system has unstable all equilibrium points for a > 0,9941. On the basis of simulations it has been shown that the fractional Lorenz system for a = 1,1 is a chaotic system with the attractor similar to the classical Lorenz Attractor.

42.
dr inż. Andrzej Ruszewski, dr inż. Andrzej Sobolewski
Politechnika Białostocka
Position control of DC motor using fractional order controller
The paper presents the problem of position control of DC motor with rated voltage 24 V loaded by flywheel. The fractional order PD controller implemented in National Instruments NI ELVIS II programmed in LabVIEW is used for controlling. Using the D-partition methodsimple method for determining stability regions in the controller parameters space is given. Knowledge of these regions permits tuning of the controller and ensures required the phase margin of the system.

43.
dr inż. Marian Wrzesień, mgr inż. Łukasz Olejnik, inż. Piotr Ryszawa
Przemysłowy Instytut Automatyki i Pomiarów PIAP
The multi-platform computer data backup system
The multi-platform computer data backup system in an organization equipped with a computer network is presented. The essence and purpose of this arrangement is to ensure the security of computer data which are processed in such operating systems as Linux, Windows, NetWare, using an integrated archiving system which communicates with the above OS systems Compatible with these systems (servers) computers are both stationary and mobile. Mobile computers are equipped with tools that enable users to synchronize those PCs to the server archiving. Synchronization occurs when you attach them to the computer network, after firstworking remotely. While archiving is applied the principle that in the organization computer system, archiving server has access to all computer data with the highest privileges. In order to allow proper collection of data by the archive server, all OS systems are equipped with tools that enable authorized, one-way access to the systems in the organization through this server. For

security reasons, when retrieving data, as well as when communicating with other OS systems, archiving server connection to other systems should be encrypted.

44.
prof. dr hab. inż. Tadeusz Kaczorek
Białystok University of Technology
Determination of positive stable realizations for discrete-time linear systems
Sufficient conditions for the existence of positive stable realizations for given proper transfer matrices are established. Two methods are proposed for determination of the positive stable realizations for given proper transfer matrices. The effectives of the proposed procedures is demonstrated on numerical examples.

45.
dr inż. Łukasz Sajewski
Białystok University of Technology
Positive realization of fractional discrete-time linear systems with delays
The positive realization problem for single-input single-output fractional discrete-time linear systems with delays in state vector and input is formulated and a method for finding a positive realization of a given proper transfer function is proposed. Sufficient conditions for the existence of a positive realization of this class of linear systems are established. A procedure for computation of a positive realization is proposed and illustrated by a numerical example.

46.
dr inż. Rafał Kociszewski
Politechnika Białostocka
Observability conditions of discrete-time singular fractional systems
The paper presents a problem of observability of discrete-time singular fractional systems. It has been shown that after decomposition of considered system into two independent systems: regular(standard) fractional system and singular system (with a nilpotent matrix N) observability conditions can be formulated in reference to standard fractional discrete-time system. Proposed approach is possible to use if the matrix $N = 0$. The considerations are illustrated by a numerical example.

47.
dr inż. Wojciech Trzasko
Politechnika Białostocka
Pointwise completeness and pointwise degeneracy of fractional discrete-time systems
In the paper the linear discrete-time non-commensurate fractional order systems is considered. Definitions and necessary and sufficient conditions for the pointwise completeness and pointwise degeneracy of standard and positive systems are given. The considerations are illustrated by examples.

48.
dr inż. Piotr M. Marusak
Politechnika Warszawska
Exploitation of properties of the MPC algorithms in fault detection

The model predictive control (MPC) algorithms due to their formulation and clever usage of the process model offer good control performance. It is also the case when some faults take place in the control system. Many of such faults can be even hard to notice thanks to the operation of the controller. It is, however, desired to be able to detect such situations. In the paper it is proposed to use internal signals of the MPC controllers in order to detect faults that occurred in the system. The method can be applied in the MPC algorithms based on both linear or nonlinear models.

49.
dr inż. Wojciech Szynkiewicz, dr hab. inż. Włodzimierz Kasprzak,
prof. dr hab. inż. Teresa Zielińska
Politechnika Warszawska
Mobile fixture planning as a discrete constraint satisfaction problem
The paper presents a planner module of a self-reconfigurable fixture system needed in the machining of thin-sheet large work-parts, mely milling and hole drilling processes. The proposed system consists of a power-supplying bench and two or more mobile robotic agents. The objective is to create an action plan for the positioningand reconfiguring of two or more mobile robotic fixtures that satisfies geometric and time-related constraints. The path planner structure, called Triple-CSP, consists of three levels of constraint satisfaction search. We propose an incremental, constraint-driven backtracking search to solve three hierarchic path planning tasks: for the supporting heads, the mobile bases, and the Parallel Kinematic Machine configurations of the mobile fixtures. The paper concentrates on the planner design and implementation and shows example plans obtained for milling and hole drilling processes.

SESSION IV - AUTOMATION AND ROBOTIC EQUIPMENT
50.
mgr inż. Grzegorz Pittner, mgr inż. Dominik Rybarczyk, mgr inż. Piotr Owczarek
Politechnika Poznańska
MEMS Technology Application In Modern Washing Machine Driver for Drum Vibration Control
Paper introduce possibilities of MEMS technology application for measurement of the rotating drum vibration in washing machine construction. The MEMS technology has been shortly presented and focused on its acceleration measurement aspects. Also generation of the unbalance force in washing machine drum has been considered. In the second part of the paper the results of the experimental comparison of the classic piezoelectric and MEMS sensors has been presented and discussed.

51.
prof. dr hab. inż. Andrzej Milecki, mgr inż. Grzegorz Pittner
Politechnika Poznańska
Modular, 32-bit washing machine controller
In the paper the basic elements used in house washing machines are presented. The principle of their operation are shortly described. In the next part of the paper authors own conception of new washing machine controller construction is presented. The proposed controller is based on 32-bit STM32 microcontroller. The controller design was described. A special attention was given to the worked out software.

52.

dr hab. inż. Ryszard Arendt, mgr inż. Andrzej Kopczyński
Politechnika Gdańska
Estimation of parameters of high power induction motor
In the paper three types of mathematical models of static squirrel cage motors and the method of estimating parameters using genetic algorithms are presented. Criteria: the sum of the squares, the sum of absolute values and integral of optimization problem are used. In selection control of algorithm a bow thruster identified mathematical models are applied. The parameters and methodology for the selection of motor models were considered for the study of their impacton the energy system of the ship are showed.

53.
mgr inż. Tomasz Kornuta, prof. nzw. dr hab. inż. Cezary Zieliński
Politechnika Warszawska
Specification of visual servo structures
The paper presents a formal method of specifying complex roboticsystems, applied to the description of three diverse robot behaviors: motion in Cartesian space to a given pose and two types of motions in which the goal was computed on the base of information retrieved from cameras (a camera integrated with the robot gripper and a camera statically mounted above the scene). The presented experimental results confirm the correctness of the developed systems.

54.
Bogdan Harasymowicz-Boggio
Politechnika Warszawska
Automatic, visual fruit sorting
The article presents the idea of a machine which can sort fruit based on the image stream of a color camera. Using a universal computer vision system for this task is a novel conception, which the author believes can allow to build an automaton able to sort different kinds of fruit without mechanical changes depending on the fruit. The main focus of the article is the vision system and the implemented image processing algorithms.

55.
dr inż. Jerzy Graffstein
Instytut Lotnictwa
Elements of collision threat detection process and automatically controlled emergency manoeuvre
In the article the idea of interaction between anti-collision and flight control systems is presented. The relationship is derived for determining threat condition for the collision between the aircraft and one obstacle, movable or not. The example of anti-collision evasive manoeuvre is analysed for several flight scenarios and flight parameters. Variations of the manoeuvre's geometry due to dynamics of the aircraft and actuators, as well as limits of control surfaces' motion, are studied with flight simulation techniques.

56.
dr inż. Piotr Golański
Instytut Techniczny Wojsk Lotniczych
Modeling of process of deck airship instrument operation in M-28 aircraft diagnostic simulator

This article applies to process modeling problems associated with the operation of deck airship instruments. It presents the results of work on defining methods for the description of the instruments action of PZL M-28 airship for diagnostic simulator. For the description of the instruments action it proposes to use language appropriately defined. It presents the syntax and semantics, and example of its use to describe the action of selected instruments. In addition, it demonstrates how to use such a formal diagnostic description in the simulator.

57.
mgr inż. Marta Grzyb, dr inż. Konrad Stefański
Politechnika Świętokrzyska w Kielcach
A comparative analysis of the guidance of a guided bomb against a ground target using a special executive system
The work presents a comparative analysis of two methods for the guidane of a guided bomb against a ground target. One of the methods analyzed was the patented solution described in Ref. [1]. The executive system includes a high-speed rotor mounted on a universal joint. The computer simulation results were represented graphically.

58.
prof. dr hab. inż. Zbigniew Koruba, mgr inż. Łukasz Nocoń
Politechnika Świętokrzyska w Kielcach
Selected algorithms of automatic guidance for armor-piercing rocket attacking a target from a ceiling
The paper presents two algorithms of automatic guidance of an armor- piercing rocket (apr)attacking a target from a ceiling. The first algorithm direct flight amr so that the velocity vector of amr in the moment of impact with the target was directed perpendicularly down wards. The second assumes amr flight just above the target during the attack. A simplified mathematical model amr and trajectory flight equations were used to carry out computer simulation of attack of target from the ceiling. The results of computer simulation are presented in graphical form.

59.
mgr inż. Dominik Rybarczyk, mgr inż. Piotr Owczarek, mgr inż.Grzegorz Pittner
Politechnika Poznańska
Implementation of the haptic fuzzy controller in the PLC
The article describes the implementation of a haptic joystick control in the PLC. Authors used the rapid prototyping methods in designed the control systems – Simulink MATLAB environment and B&R Automation Simulink Target for Automation Studio tool. The control signal which was generated in the PLC has been sent to the motor drivers hit of each axis. The primary driver was tested with fuzzy and proportional controller. The results has been compared. System was tested in the simulation and in the experimental researches.

60.
dr inż. Ryszard Leniowski
Politechnika Rzeszowska
Generating spatial trajectories for surgical robot using a 6 DOF semiconductors motion sensors
The paper presents an alternative approach to the construction of the surgical robot trajectory haptic console by the use of motion MEMS type sensors: compass, gyro, accelerometer.

Miniature module with these elements can be applied directly to the surgeon's hand or can be located on his fingers. The advantage of this device is not only low price, but also a high level of functionality associated with openness to adding new software modules. An example of built-in function can be the generator of a come path to the surgery field by the use of spline polynomials in the Catmull-Rom representation. In addition, the haptic console is very small and easy to use in mobile systems (military field ambulances).

61.

dr Zbigniew Nawrat*, dr inż. Paweł Kostka**
*Fundacja Rozwoju Kardiochirurgii im. prof. Zbigniewa Religi w Zabrzu, **Śląski Uniwersytet Medyczny w Katowicach
Robin Heart – preparation to clinical debut
Paper presents the current works led in Zabrze's team connected with project of Robin Heart surgical robot. Preparatory work is underway in the field of safety and functionality for the first application of robot Robin Heart Vision in the clinic.

62.

dr inż. Paweł Kostka*, **, dr Zbigniew Nawrat*
* Fundacja Rozwoju Kardiochirurgii w Zabrzu, **Politechnika Śląska w Gliwicach
Man-Machine interfaces in the structure of control and vision system of Robin Heart surgery telemanipulator
New construction of Man-Machine Interfaces, 3D vision channel and control system structure of Robin Heart surgery telemanipulator are presented. Input module of control system work on the base of reprogrammable FPGA chip, which revealed to be an universal and elastic solution for different types of sensors in Master tool. New Master/ Operator devices make possibile to use both upper and lower limb to control the robotnic arm. Prepared system was tested on several animal experiments and long distance teleoperation.

63.

dr inż. Waldemar Małopolski, inż. Grzegorz Madej
Politechnika Krakowska
Testing programs for PLC in the Arena simulation environment
This paper presents a method of integrating the PLC emulator with controlled object model built in Arena simulation environment. The aim of such integration is to check the correct operation of the control program and the controlled object.

64.

dr inż. Stanisław Krenich, mgr inż. Łukasz Hendzel
Politechnika Krakowska
Control of 3D virtual models of manufacturing systems in the CATIA/DELMIA application using PLCs
The paper presents a method to create and control virtual threedimensional models (3D) of manufacturing systems with the use of PLCs. The possibilities of building a virtual model by using of 3D elements, introducing motion transmission constraints and the internal logic of individual devices or more complicated manufacturing systems in the CATIA/DELMIA application are presented. Then the procedure of the real time control of the virtual model using the external GE Fanuc RX3i programmable logic controller is introduced. The idea of control is

based on the use of standard PLC communication protocols and the OPC server (KEPServerEX) as an interface application. The control procedure was tested on a 3D model of manufacturing cell equipped with a CNC lathe machine, gantry manipulator, pallet changer and a pallet rack storage system. Practical experiments confirmed the efficiency of the developed method.

65.

mgr inż. Bartosz Brzozowski, dr inż. Maciej Henzel, mgr inż. Paulina Mazurek
Wojskowa Akademia Techniczna
The FPGA implementation of the PID controller for the active magnetic bearing with permanent magnets
In this article was presented an PID algorithm and its implementation in the control system of an active magnetic bearing. For input and output analog data parallel converters from Texas Instruments were used too. Digital PID algorithms were implemented and tested on FPGA chips from Xilinx Spartan Family. Results were compared with the results of PID controller simulated in MATLAB/Simulink. The control system with the most optimal PID algorithm's implementation and adjustment was detailed.

66.

dr inż. Krzysztof Falkowski
Wojskowa Akademia Techniczna
The model of the passive magnetic bearing
There is presented analytical method estimation of the static characteristic of the passive magnetic bearing. The loop with molecular current model is used to obtain the analytical model. The characteristic decides about the load of the passive bearing. The change of magnetic force is proportional to position the rotor in the air gap of bearing. In the paper is presented construction of the passive magnetic bearing and analytically relationship between position the rotor in the air gap and magnetic force. The author is present relationship between the static characteristic estimated by finite element method and experiment.

67.

dr inż. Krzysztof Falkowski, dr inż. Maciej Henzel, mgr inż. Paulina Mazurek
Wojskowa Akademia Techniczna
The mathematical and simulation model of the bearingless motor with permanent magnets
The airborne systems of the newest aircrafts are designed in the more electric aircraft (MEA) technology. This technology make an assumption of the use more electrical elements in onboard systems to reduce weight, easier maintainability and more dependability. The MEA technology is implemented in aircraft control and actuation systems, too. In the Military University of Technology was designed the new construction of the motor with permanent magnets. The paper are presented the mathematical model of the motor and the simulation results.

68.

dr inż. Robert Bączyk, mgr inż. Dawid Lewandowski, mgr inż. Piotr Pluciński
Politechnika Poznańska
Sensing and control in didactic unit of magnetic levitation
The subject of this paper is the design and analysis of magnetic levitation system. The whole work consists of the simulation model and constructed device enabling stabilization of the levitating object. Designed and built device provides a current control of the electromagnet in the

inner loop and the position control of the object lifted – in the outer control loop. In addition, the controller communicates with the application that runs on a PC, which supervise the work of the driver. On the device are mounted and tested three different position sensors.

69.
mgr inż. Piotr Owczarek, mgr inż. Dominik Rybarczyk, mgr inż. Grzegorz Pittner
Politechnika Poznańska
The research of the swinging up and stabilization algorithm of inverted pendulum with the vision feedback
The article shows the control algorithms responsible for swinging up and stabilizing operation from downward to upward position. There resigned from traditional measurement methods like using encoders or potentiometers in order to using innovative solution like digital image processing from camera data. The discrete PID regulator and swinging up algorithm was described. The main feedback was the information from the camera. The research proves that low frequency of the vision feedback gives correct regulation effect. At the end the inverted pendulum stabilizes in the unstable equilibrium point.

70.
prof. dr hab. inż. Gabriel Kost, dr inż. Daniel Reclik, dr inż. Wacław Banaś, Tomasz Dzitkowski, Andrzej Dymarek, Piotr Ociepka, Krztsztof Herbuś, Grzegorz Gołda
Politechnika Śląska
Idea of simulator for driving course for handicapped people: system assumptions, specification of accelerations in street traffic by the usage of experimental methods
The project of creating the specialized simulator for driving course for handicapped people have started at Silesian Technical University in 2010. The main goal of this project is to enable handicapped people to get used in save way to driving a car outside the street traffic. Driving this kind of car extremely differs from driving a typical car, because it needs to use additional gas and break lever. It is also so difficult to get used to it, because by the usage of the same hand, the driver must change runs, breaks and using the switch of windscreen wipers. The created car simulator is very similar to the real car for handicapped people just to teach them the correct behavior and habits during driving a car before they have started to drive in real street traffic. Moreover, there was necessary to prepare the project system of overloads, which can appear in the car during street traffic just for better getting used to the car. This solution provides to get into the correct habits, e.g. reducing the speed before the turn. There has been made an experiment by using the real car equipped with accelerating sensors located in a few places surrounding the drivers space to determine the suitable values of overloads, which are possible to generate by the carrying platform driving system of the simulator. The obtained results show that the overloads values are the base for further assumptions connected with motive power of the simulator carrying platform. This paper contains the detailed description of preparing the assumptions and idea of the simulator. Moreover, there is presented the overall description of the work-place, the assumptions of the functional structure, and the way of determining the accelerating values connected with feelings simulation as one can find in a real car.

71.
prof. dr hab. inż. Gabriel Kost, mgr inż. Andrzej Nierychlok
Politechnika Śląska
Virtual adaptive control algorithm of wheeled power train vehicle

The paper presents a virtual model of a Wheeler vehicle propulsion system with an adaptive algorithm of engines: ICE and electric motor. This paper details the algorithm ICE unit as a source of primary energy in the propulsion system, and used the synergy of energy.

72.

prof. dr hab. inż. Gabriel Kost, dr inż. Daniel Reclik, dr inż. Wacław Banaś
Politechnika Śląska

Data acquisition system from car cockpit applied in simulator for driving course for handicapped people

The project of mechatronic integrating unit for steering of the simulator for driving course have started on Silesian Technical University in 2010. This simulator is destined for initial phase of learning how to drive a car for handicapped people, because of their huge problems with preparation to the driving license exam. Mainly, those problems are connected with the necessity of suitable car preparation by themselves, e.g. application of additional levers which replace gas, break and clutch pedals. Another problem is that, it is very difficult to find an instructor who will carry out the driving course with using a private car. To make getting used to street traffic more easy for handicapped people, there was necessary to work out a special technology of full integration of simulator steering system with car instrumentation. The point is that the simulator must remind as much as it is possible the realcar use. In this paper there is presented the project and data acquisition system applied in FIAT PANDA. This data acquisition system can read off the position of all applied switches which are attached on car board and in steering gear column. The read data are loaded to industrial steering system based on PLC controller. This solution is necessary to use if the system is applied in mechatronic integrator system for procedure steering of simulator for driving course for handicapped people, because the whole project is based on industrial solutions for servo steering drives. Moreover, there was necessary to replace all car board elements with other components because industrial automatic systems work on different voltage values than the on-board car installation. Furthermore, the main point is that, the new car structure must fulfill the two assumptions: it must fulfill standards of industrial automatic systems and it must cover every single switch and cable as it is in real traditional car. Those things are so important because the main goal of this project is to guarantee the handicapped people to feel exactly the same as they are in a real car in traffic street.

73.

mgr inż. Dariusz Steckiewicz, dr inż. Robert Piotrowski
Politechnika Gdańska

Mathematical model of propulsion system of an internal combustion engine car and simulation studies

The propulsion system of an internal combustion engine car is a complex physical object. In the paper its mathematical model based on the physics of the vehicle movement was constructed. Next, the identification of the model`s parameters was made. A simulation model was worked out and its verification was carried out using real data. The obtained results were analyzed.

74.

mgr inż. Paweł Bachman, mgr Marcin Chciuk
Uniwersytet Zielonogórski

2-DOF haptic joystick HapticUZ 2-DOF/DC

The article describes the construction and research of 2-DOF active haptic joystick, which uses DC motors as components that cause a sense of touch.

75.

prof. dr hab. inż. Andrzej Milecki*, mgr inż. Paweł Bachman**, mgr Marcin Chciuk**
*Politechnika Poznańska, **Uniwersytet Zielonogórski

Research of impact the demagnetization process on the magnetorheological rotary brake hysteresis loop

The article presents the basic properties of ferromagnetic and theoretical knowledge of their magnetization and demagnetization. The second part presents the research according to the quality of demagnetization of magnetorheological brake demagnetizing signal parameters. The final part of the article's conclusions regarding the optimal values of frequencies used for demagnetizing the brakes.

76.

mgr inż. Paweł Bachman
Uniwersytet Zielonogórski

The selection of haptic devices construction depending on the size and type of forces occurring in the controlled system

The article includes tips for haptic device designers. In addition describes the distribution of haptic joysticks because of the nature the element responsible for causing feelings of touch. Describes a multidisciplinary haptic devices industry and its linkages with the various branches of science. Then a sample of haptic devices belonging to different types and a brief description of their design are described. All the haptic joysticks features described in the article are summarized in table and assigned to particular groups. On this basis, drew conclusions that the building should have a perfect haptic joystick and drawing its construction is showing.

77.

mgr inż. Paweł Bachman, dr Piotr Gawłowicz
Uniwersytet Zielonogórski

Haptic assisting interface with the MR fluid

The paper control systems using haptic devices and the basic properties of magneto-rheological fluids described. The study braking torque depending of current flowing through the magneto-rheological brake coil are presented. The final part of the article construction and testing of electric linear actuator with DC motor controlled with a haptic joystick with magneto-rheological rotary brake described.

78.

mgr inż. Paweł Bachman**, mgr Marcin Chciuk**, prof. dr hab. inż. Andrzej Milecki*
*Politechnika Poznańska, **Uniwersytet Zielonogórski

The control of active haptic joystick HapticUZ 1-DOF/DC

The article electro-hydraulic servo control system by the operator via a joystick with force feedback describes. Given the intention to use wireless communication, built in MATLAB/Simulink simulation model of the system. Conducted simulation studies the behavior of the system in case of temporary loss of connectivity. Algorithm estimates based on information transmitted differential signal previously received is proposed and modeled.

Simulation studies have shown that the proposed algorithm is effective for the studied cases signal loss and protects the drive against step signal changes.

79.
mgr inż. Paweł Bachman**, mgr Marcin Chciuk**, prof. dr hab. inż. Andrzej Milecki*
*Politechnika Poznańska, **Uniwersytet Zielonogórski
The control of active haptic joystick HapticUZ 1-DOF/DC
In the paper the construction and testing of 1-DOF active haptic joystick, which uses a DC motor as the elements that cause a sense of touch, are described. Additional opportunities offered by control systems with haptic devices in steering with force feedback are presented.

SESSION V - MEASUREMENTS DEVICES AND SYSTEMS
80.
dr inż. Stanisław Popowski, inż. Radosław Rybaniec
Instytut Lotnictwa, Warszawa
Measuring and estimating selected flight parameters of autogyro
In the article the system for measurement and estimation of flight parameters of autogyro is presented. The structure of the system, its functionality and operating principles of selected sensors are addressed in details. Results of in-flight tests of the system are also presented. These tests have been conducted on Xenon autogyro, manufactured by Celier Aviation company.

81.
dr inż. Witold Dąbrowski, mgr inż. Stanisław Popowski
Instytut Lotnictwa, Warszawa
Altitude and rate of climb measurement on flying objects
In the article the system for altitude and rate of climb measurement is proposed. Three sources of information are integrated in the system barometric altitude, vertical acceleration and altitude acquired from GPS system supported by SBAS. Presented solution (being applied off-line) is verified by simulation tests as well as by computations with results of real in-flight tests completed on Celier's auto-gyro Xenon.

82.
dr inż. Paweł Fotowicz
Główny Urząd Miar
Historical aspects of expressing the measurement uncertainty
Historical basics concerning the analysis of a measurement data were appeared in XIX century. They were formulated as a method of least squares, law of error propagation and central limit theorem. The inference treating measurement error as a histogram and expressing it asa uncertainty was also completed. Nowadays this approach justifies expressing the measurement result as a measurand described by the probability distribution.

83.
dr inż. Bogumiła Mrozek*, mgr inż. Dariusz Felka**
*Politechnika Krakowska, **Instytut Technik Innowacyjnych EMAG w Katowicach
Intelligent fire hazards indicator model in coal mine
Significant influence on detecting the fire hazard of belt conveyor in the coal mine have values such parameters as concentration of carbon monoxide (CO), concentration of hydrogen cyanide

(HCN) and signals from smoke detectors. Those values are used to set the fire risk index. Fuzzy model of the fire risk index was built based on laboratory data measurements. Fuzzy model was generated from the above numerical data using four algorithms of fuzzy clustering, implemented in the MATLAB code. The results are shown in tables and graphs. MATLAB and Fuzzy Logic Toolbox library (functions and interfaces) were used to design and visualize the proposed fuzzy model.

84

mgr inż. Jakub Szałatkiewicz, mgr inż. Rafał Kłoda
Przemysłowy Instytut Automatyki i Pomiarów PIAP

Automated measurement system for investigation of arc plasmatron characteristics

The paper, presents automated measurement system for investigation of key arc plasmatrons parameters. Automated measurement system allows to simultaneously and broadly investigate plasmatron work parameters. Collection of plasmatron operational data is required for optimization of theirs construction, efficiency determination, energy balance calculation, and calibration. Plasmatrons are powered with electrical energy and work gas, theirs cooling is carried out by water circuit. Work parameters of plasmatrons are depending on many factors, theirs geometry, power, gas flow and cooling. So to investigate influence of each factor, it is necessary to perform many simultaneous measurements. Each measurement of physical value is performed by specialist combined sensor, located in measurement cabinet. Such approach allows for integration of all the measurements and digitalization of collected data in one place. Measuremetns have to be performed during normal operation of plasmatron, to allow such action, the measurement cabinet is equipped with connections allowing to hook it up to the plasmatron circuits. Developed automated measurement system carries out key measurements of plasmatron parameters: voltage, amperage, power, flow of plasma gas, flow and temperature of cooling fluid for anode, and cathode. Measured values, are simultaneously stored each second, and visualized in application software developed in LabVIEW, on PC. Based on collected data the software of automated measurement system calculates energy balance, efficiency, and other important parameters of plasmatron during its exploitation.

85.

mgr inż. Dorota Jackiewicz*, prof. nzw. dr inż. Roman Szewczyk, dr inż. Jacek Salach***
*Politechnika Warszawska, **Przemysłowy Instytut Automatyki i Pomiarów PIAP

Modelling the magnetic characteristics of construction steels

Paper present the possibility of use Jiles-Atherton extended model to describe magnetic characteristics of construction steel *ST3*. It was considered not only hysteresis loop but also the initial magnetization curve. The obtained modelling results are in good agreement with the experimental characteristics. This agreement is confirmed by high value of the R2 determination coefficient. Presented modelling results of the magnetic characteristics could be used to describe and predict the influence of fatigue process on magnetic characteristics. This enables estimation of fatigue state of steel elements, on the base of its magnetic characteristics measurement.

86.

dr inż. Jacek Salach*, prof. nzw. dr hab. inż. Adam Bieńkowski*,
prof. nzw. dr hab. inż. Roman Szewczyk, mgr inż. Dorota Jackiewicz*,**
mgr inż. Piotr Frydrych*, dr Aleksandra Kolano-Burian*

*Politechnika Warszawska, ** Przemysłowy Instytut Automatyki i Pomiarów PIAP,
***Instytut Metali Nieżelaznych

Utilizing of magnetic amorphous alloys in magnetoelastic tensile stress sensors

Paper presents possibilities of utilizing Fe77Cr2B16Si5 amorphous alloy in development of magnetoelastic tensile stresses sensors. In presented sensors the uniform distribution of tensile stresses was achieved. These stress were perpendicular to the direction of magnetizing field in the ring-shaped core. Presented results indicated high magnetoelastic sensitivity of Fe77Cr2B16Si5 amorphous alloy under tensile stresses. Moreover it was indicated, that magnetoelastic sensitivity increases due to thermal relaxation – annealing of amorphous core.

SESSION VI - ECONOMIC AND SOCIAL ASPECTS OF AUTOMATION AND ROBOTIZATION.

87.

dr inż. Krzysztof Krupa
Politechnika Krakowska

Simulation of economic and social results of robotisation

Application of robots in manufacturing is profitable and thus it is a natural trend. Is it, however, possible to replace the human being completely? What social and economic impact of such operation could be? An attempt to answer such question is presented in the paper.