ABSTRACTS

Nikat Akkus, Garip Genc, Cemal Girgin
Control of the pretension in filament winding process

A tension control system which simulates the effect of tension force in the filament winding machines has been designed and implemented in the present study. Filament Winding (FW) machines are widely used in Fiber Reinforced Plastic (FRP) composite production systems in which they have a pretensioning system to optimize the tension of the fiber during winding process. The precise control of the winding path needs highly mechatronic systems. The designed control system consists of magnetic break, servo motor, a PID control unit, a load cell and a data converter. The tension of the carbon fiber was measured by a load cell and compared to the preset value to keep the tension of the carbon fiber in predefined certain range.

Orest Bazylevych, Orest Ivakhiv, Roman Velgan
Procedure of distances evaluation for surface inspection

In the context of developing automated optical inspection system, this work brings into focus the aspect of development of evaluation algorithms for thickness distribution extraction from the object model reconstructed after surface scanning. Within this work an algorithm for the evaluation of local differences between two triangle meshes is presented. The pair of triangular meshes is representing the front and backside of a scanned 3D-object. The resulting array of differences vector corresponds to the shortest local distances (i.e. local thickness) between sides of object.

Ivars Beinarts, Anatoly Levchenkov, Peteris Balckars
Control of heating processes in transport mechatronic system using sigmoidal feed forward neural network

In this article interest is concentrated on the climate parameters optimization in passengers' interior of mechatronic systems (public electric transportation vehicles- train, tram or trolleybus). Idea is to use feed forward artificial neural network to create an algorithm and coordination mechanism for heating system parameters control to save electrical energy, and to increase the level of comfort for passengers. A special interest for investigations and further development is devoted to intelligent HVAC system allowing more flexible control of the system's compressor, fan and heater operation, and, therefore, improvement of efficiency and energy saving. This paper provides the mathematical model and algorithm for optimal control of the climate control system.

Mariusz Bogdan
Computer processing of some surface images of technical objects after influence of the high temperature conditions

Computer processing of the image of surface of operating gas turbine blades was proposed in order to make the method of the evaluation of the condition of these blades more objective. The dependences and connections between the degree of blade material overheating and the colour of analyzed surfaces were shown on the basis of images registered in visible range of electromagnetic wave (digital image – Charge Coupled Device matrix). The proposal of methodology to assign the overheated areas on the blade's surface in order to assess the range (of degradation) of thermal usage of the blade and to forecast it's working resources, might be useful to monitor the situation in the operating conditions. Moreover in the article the problematic of acquisition of the form digital images dates was presented by showing physical basis of analysis of reflected signal from metallic surface are showed in aspect of recording by photoelectric light sensor (matrix CCD).

Norbert Chamier-Gliszczyński
Disassembly modeling of the mechatronic systems for reuse and recycling

This paper presents processes modeling disassembly of the mechatronic systems for reuse and recycling. Typical steps in modeling and analyzing disassembly processes consist of the following: the objective of the model is stated, a mass flow diagram consisting of acquisition, sorting, disassembly processes, and recycling process of the facility in developed, modeling disassembly processes, disassembly process planning, optimal disassembly sequences: (generation of feasible disassembly sequences, adaptive disassembly processing, selective disassembly, destructive disassembly).

Agata Dudek
Investigation on the microstructure of the HAP and YSZ composites

Group of bioceramic materials includes, among others, hydroxyapatites (HAp, OHAp, HA), which, due to their specific properties are widely applied. These compounds are currently present in bone systems of human and animal bodies. One of the solutions for improvement of poor properties of HAp is addition of zirconium oxide which is characterized

by high biological tolerance and enhanced mechanical properties. Application of bioceramic materials as coatings for implants introduced into human body due to their bioinertness and biocompatibility enables overcoming immunology barriers. One of the fundamental advantages of ceramic materials is their positive impact on human tissues. The investigations involved creation of composites through single-axial compaction of two ceramic powders (HAp+YSZ) and then their sintering at the temperature of 1300oC for two hours. The aim of the investigations was to determine thermal stability of hydroxyapatite (Fig. 1) and HAp + YSZ (Partially Stabilized Zirconia) (Fig. 2) and impact of addition of YSZ (8%wt. Y2O3 stabilizing ZrO2) on phase composition of the prepared composites after the process of sintering.Investigations of the structure have been performed using JEOL JSM 5400 (Fig. 4, 5) scanning microscope while phase composition have been carried out by means of Seifert 3003 T-T X-ray diffractometer (Fig. 6, 7).

Aleksandr Gubarev, Oleg Jachno, Oksana Ganpantsurova
Cyclic-modular approach to development of electronically-mechanical control systems of the pneumatic drive

The module approach for build-up of cyclic action systems is considered. The main property of approach is system decomposition on cyclic action subsystems (modules). All modules have same structure: actuating device (drive), control device (directional valve), status sensors. Methods of approach application are realized by means of graphs. Advantage of module approach is possibility of physically heterogeneous devices combination (devices with pneumatic or hydraulic control, electro-relay or PLC) not only in all system, but also inside of each modulus, that reduced a number of signal conditioning devices. Such synthesis is possible owing to a minimal structure of each modulus.

Marek Hryniewicz, Jan Anthonis, Herman Ramon
3D apple modeling with the use of the structured light method

The geometrical fruit model could affect many physical phenomena, such as heat, mass and moisture transfer, pneumatic transport and mechanical vibrations which occur during handling and processing fruits (Jancsok, 1999). The fruit geometrical model could be further studied by the Finite Element Method (FEM) (Jancsok, 1999). Incidence of bruises is the most important type of postharvest mechanical injury (van Zeebroeck, 2005). The reason for this is that the causes and mechanisms of impact and vibration are complex and interrelated (van Zeebroeck, 2005). In mechanical engineering a geometrical model of the structure to be analyzed is usually available as CAD drawing which can be imported directly in FE software (Jancsok, 1999). However, for agricultural-, bio- and food- materials there are no geometrical models available so they have to be defined manually, which is complicated by the complex shape and the shape variability of these products (Jancsok, 1999). Dintwa (Dintwa, 2006) stated that the 3D simplified models used in the dynamic experiments were not accurate enough, most certainly because of the coarse discretization used with these models. This paper describes a system for complex shapes geometrical modeling. The system was implemented in real apple modeling. It was developed on structured light method elaborated by Sitnik (2002). The method has advantages and disadvantages. Advantages: modeling of complex shapes, recalculation of many points at one moment, at least only 3 views for one figure, measurements without object touching.
Disadvantages: problems with light reflection.

Tatjana Ivanova, Janis Rudzitis
Traceability and capability control of mass measurement equipment and drift statistical analysis of national mass standards in Latvia

LNMC is highest metrological institute of Latvia. The paper describes national mass standards currently in use, their traceability, stability, mass measurement equipment and related techniques.

Roman Z. Kacprzak
Applicability estimation of a low-cost haptic device for the purpose of steering the mobile platform

In this paper a concept of using an easily accessible (i.e. commercially available for common home user) model of enhanced user interface – Haptic Device – for purpose of steering a mobile platform is presented. The functional requirements for the investigated device are specified based upon literature sources and verified empirically by author by performing real-time experiments in Matlab\Simulink.

Bronius Karaliunas
Computer modeling of the characteristics and magnetic field of single - phase commutator motor

The article presents some calculation results of dynamic characteristics of the single – phase series – excited commutator motors and magnetic field analysis. Single – phase commutator motors in up – to – date literature are called universal motors, because they can be used in both alternating current (AC) and direct current (DC) systems. The single – phase AC small power commutator motors are widely used in different vacuum cleaners, electric tools, drives

of household, electrical, medical and hygienic equipments and porta-ble electrical hand tools. However, the principal defect of those motors is worse commutation with sparkling between brushes and the collector, and high enough level of radio interferences on wide frequency range. In this article obtained expressions compounds the mathematical model of the single – phase series – excited commutator motor. The model of the dynamic processes of the motor and its block diagram are compiled according to the differential equations which were derived from the equations of voltage balance. The software of Matlab/Simulink is applied here which has integrated the methods of the solution of differential equations for the motor. For modeling the magnetic field of a AC series – excited commutator motor there was used the software JMAG. The program is complied by means of finite elements, by attaching on the computer separate geometric figures their titles and character-ristics. Since the magnetic field in the air gap between the salient poles and armature is not homogeneous, so the density of the grid has to be the highest. The obtained results of modeling describe a very complicated structure of a magnetic field of a commutator motor for the analysis of which are required new and comparatively accurate mathematical models.

Gabriel Kost, Daniel Reclik
The 2 ½D algorithm in robot workspace analysis

In this paper there is presented the method of 3D manipulator's workspace analysis. The analysis of robot's work-space is necessary for generation the safety movement path. There was 2 ½ D method, which is based on algorithm of following sections defining in robot work area. Those sections are explored by flat analysis, but the results are transposed into graph form. This graph is the record of all possible movements, so to get the optimum movement there must be used Floyd's algorithm. This, shortest trace is optimized and smoothed by using B-Spline curves.

Mustafa Kurt, Hasan Geyik, Bilçen Mutlu, Yaşar Tatar , Ergun Nart
Design, prototype and experimental evaluation of a wheelchair treadmill

Generally, wheelchair users cannot move easily within buildings since living areas in architectural structures are not suitable for them to maintain or to improve their physical capabilities. Because living area restrictions affect the physical performance of the users outside during the day, the reduced mobility causes several health problems. These problems become more intense by the time. Especially heart and lung related illnesses are common among the wheelchair users since the immobility decreases respiration capacity. The aim of this research is to design and prototype a wheelchair treadmill to help wheelchair users improve their upper extremity system. In this study, CAD was employed for the design of wheelchair treadmill. Then finite element analysis (FEA) was carried out for the parts of the wheelchair treadmill and the prototype was manufactured based on the results. The prototype was tested under the conditions the product was originally intended to function. In the experiments, the speeds of wheelchair and wheelchair treadmill were measured. The distances taken by users were also recorded, and the results were evaluated with respect to road surface conditions.

Dmitry Litvinov, Janis Rudzitis
High frequency vibration monitoring and diagnostics of high-speed pump rolling bearings

Evolution of modern industry makes great demands to reliable work of pump equipment with large revolutions number of rotating parts. Under special supervision must be the centrifugal high-speed pumps. One of the major and hardly loaded units of high-speed pump equipment are rolling bearings, therefore it is very important to conduct monitoring and early diagnostics works to find out defects in them. For the high-frequency vibration detection and analysis it is possible to use both stationary and portable systems of monitoring and diagnostics. This diagnostics advantage is early detection of aberration from normal operation of rolling bearings and transition from equipment service and repair on-schedule to real situation service and repair, which is determined on periodic diagnostics results.

Cristina Pana, Viorel Stoian
A fault-tolerant control system for a hexapod mobile robot

This paper presents a fault-tolerant control system for a hexapod mobile robot. First, a description of the dynamic model of the hexapod mobile robot by a system of differential equations is made and after that, a representation of the system in state variable space is obtained. A fault detection and identification algorithm is proposed. The modality used here is an analytical redundant process, which supposes that the processing of the information is made at a superior level for the identification of the changes due to the faults. By this method, the actualized model obtained by the on-line identification of the system, is permanent compared with nominal model (without faults). The adaptive control system for uncertain non-linear systems proposed here has two main blocks: adaptation mechanism block which implements the mathematical model of the adaptation error and control law accommodation block which changes the characteristics of the control law. Finally, the authors propose the hexapod mobile robot which is open to fault events, to be a variable structure system and analyze a specific control method.

Ilhan Tarimer, Serkan Örücü, Rıza Gürbüz
Developing an educational software controlling data transfer of serial and parallel ports

In this study, it has been examined whether computer-based teaching software is applicable in today's electronic and computer teaching. By the improvement of today's computer teaching, people are able to reach information easily. Both indoor and outdoor of classroom works, teaching software, which supports learning, has been aimed to help both teachers and students. The educational software prepared in this study that can be used in the area of controls with parallel and serial computer ports. In this study, basic properties of parallel-serial ports, to use them in mechatronics and their using facilities have been explained. How to program these ports together with their connections have been embedded into the educational teaching software. Thus, according to its algorithm and frame, this educational software interface developed can be used for general mechatronics training

Abdullah Uzun, Fahri Vatansever
Ismail Al Jazari machines and new technologies

Al-Jazari was a 12th Century Turkish Scientist, Engineer and writer. His full name was Badi Al-Zaman AbulI-Izz Ibn Ismail Ibn Al-Razzaz Al-Jazari. He lived in Diyarbakir region in Turkey (1206 AD). As his town name is Cizre, the modern Turkish scripting of Jizra , his last name is known as Jazari (Uzun, 1997). Badi Al Zaman means "prodigy of the Age" and was applied to other well-known men (Hill, 1974). He served the Artuks a Seljuks dynasty in Diyarbakir, as a chief engineer – as did his father before him. He invented the crankshaft and some of the first mechanical clocks, driven by water and weights- used water power. He authored and drawed 60 inventions in his book "Al-Jami Bain Al-Ilm Wal-Amal Al-Nafi Fi Sinat'at Al-Hiyal" (The Book of Know-ledge of Ingenious Mechanical Devices). Kitab al-Hiyal is an interesting work on automatic control mechanism, fountains, devices, pipes, valves and siphons. The importance and originality of Kitab al-Hiyal is due to its being an earlier example of the automatic control studies in the history. There are a number of ma-nuscripts of Jazari's work in Oxford, Leiden, Paris, Dublin and İstanbul. Equally cranks may have first been documented by Al Jazari – 300 years before western engineers achieved this (Francesco di Giorgio Martini and Leonardo Da Vinci). He used some kind of symbols for understanding of his drawings like using of electronic circuits. We found that his machine drawings and manufacturings quite qualified understanding (http://orionrobots.co.uk/tiki-index.php?page=Al+Jazari). The aim of this study is to review and examine Al Jazari's drawings and then, to compare and examine with the new technology period.

Marius Vasylius, Vytautas K. Augustaitis, Vytautas Barzdaitis, Marijonas Bogdevicius
Dynamics of the air blower with gyroscopic couple

To avoid damaging of tilting pad journal bearings, the problem of safety shut down of high speed air blower cantilever rotor becoming important in modern industry. The experimental testing, modeling and simulation of dynamic behavior of rotating system was run to directly evaluate gyroscopic negative effect damaging journal bearings. A dynamic model of air blower rotating system was designed and simulated. A simulation and experimental measurement results of rotating system were used to optimize the shut down regime of machine. Gyroscopic effect influences of rotor bearing stability are confirmed. Results of numerical simulation confirm results of experimental vibration measuring. The theoretical research results are given and conclusions are made. Experimental testing and simulations results was applied to typical air blower rotating systems for elimination of huge negative forces acting on new bearings during shut down of the machine.

Arkady S. Yuschenko, Dmitry N. Morozov, Andrey A. Zhonin
Speech control for mobile robotic systems

The experience and intelligence of human are necessary to fulfill the hazardous and responsible operations by mobile robot in undetermined environment. To make the control process more effective and simple for human the speech control may be used. The operator's interface in this case may be created using the linguistic variables both for commands formalization and for information presentation. The speech controlled robot has to be an autonomous intelligent system capable to re-cognize the current situation and to adopt its behavior to real environment. To adopt the artificial intelligence to the human impression and reasoning the fuzzy logic principles may be used to create the knowledge base of a speech controlled robot. The simple manipulation and locomotion operations may be presented in form of fuzzy production rules. For complicated modes of behavior the procedure of fuzzy AI – planning have been proposed. The procedure of robot learning on the base of fuzzy neural networks has been developed .for the situations when human-operator can not formalize the fuzzy rules of robot behavior beforehand.