COMEFIM 10

The 10-th International Conference on Mechatronics and Precision Engineering

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Organized by:

University "POLITEHNICA" of Bucharest – Faculty of Mechanical Engineering and Mechatronics
Department of Mechatronics and Precision Mechanics – R & D Centre for Mechatronics

In collaboration with:

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R & D National Institute for Mechatronics and Measurement Techniques, Bucharest

University "Transilvania" of Braşov – Department of Precision Engineering and Mechatronics

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PLENARY SESSION

1. Smart Pneutronic Equipments and Systems for Mechatronic Applications

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Abstract: Evolution of pneumatics has undergone through different phases: fluidics, logic pneumatic elements, integration with electronic devices and optical systems. Actually, integration between pneumatics and electronics carry to Pneutronic Systems, as part of Mechatronics. Some important points to design and to improve the pneutronic systems are: the use of new materials; the use of nanotechnologies; integration with smart electronic devices; use of rapid prototyping technologies; the use of proper CAD/CAE software. The energy saving in pneutronic systems can be obtained in various ways such as: limiting the supply pressure; using a non atmospheric vent pressure; recovering kinetics energy. The mechatronic applications for production systems with high efficiency are revealed too.

Keywords: pneutronic systems; mechatronic applications; energy saving.

2. Porosity - Mechanical Behavior Correlation in Cranial Implants

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Abstract: Recent advances in Computer Aided Design and Manufacturing techniques (CAD/CAM) have facilitated the rapid and precise construction of customized implants used for craniofacial reconstruction. Data of the patients' trauma, acquired through Computer Topographies (CT), provide sufficient information with regard to the defect contour profile, thus allowing a thorough preoperative evaluation whilst ensuring excellent implant precision. During the selection, however, of a suitable implant material for the specific trauma, the mechanical aspects of the implant have to be considered. This investigation aims to assess the mechanical strength, the shock resistance and the critical deflection of cranial implants manufactured with Ti6Al4V. To achieve this, a set of compression specimens with varying porosity and poore size were developed and their bulk elasticity modulus determined which was further on used as input for the FEM simulation of a cranial implant under different loads to evaluate the structures mechanical behavior.

Keywords: cranial implants, manufacturing techniques

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3. CYBER – Physical Systems – New Challenge for Science and Technology

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Abstract: Networked ICT Systems ('e- Networks') have prevaded in all traditional infrastructures, rendering then more intelligent but more vulnerable at the same time. Some factors and challenges are the developing of the wireless sensors/actuator networks (WSAN) and the increasing the complexity of the systems and the diversity of the embedded devices working into large networks. 'CYBER – Physical Systems' are a next generation network, connected collection of loosely coupled distributed cyber systems and physical systems monitored/controlled by user defined semantic laws, are integration of computation with physical processes. The main problems are: how to build predictable real-time network CPS at all scales; how to build and manage dynamically – configured systems.

Keywords: network, real-time network, intelligent systems.

4. Education, R&D in Mechatronics at University POLITEHNICA of Bucharest – Department of Mechatronics and Precision Mechanics

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Abstract: The paper presents scientific concerns and education activity of the Department of Mechatronics and Precision Mechanics from University POLITEHNICA of Bucharest. As

the host of the jubilee conference – COMEFIM 10, the authors present a short history of the COMEFIM conferences and the education, research and development achievements of the department. The main areas of interest, which are also topics of the conference, are pointed out: Robotics, Actuation and Precise Automated Systems; Manufacturing Methods and Techniques; Biomechatronics and Medical Instrumentation; Measuring Systems and Metrology; Fine Mechanisms and Precision Mechanics Systems; Optical Devices and Instrumentation; Mechatronic Systems.

Keywords: mechatronic systems, research, university.

5. R&D in Mechatronics at the National Institute of Research and Development in Mechatronics and Measurement Techniques

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Abstract: The main areas of expertise include fundamental and applied researches, technological developments in the field of: mechatronics, integronics and intelligent mesurement techniques, medical and rehabilitation devices and systems, investigation and analysis equipment, micro-nanotechnologies. INCDMTM Bucharest participates in the network ROMNET MIN AFAB (Romanian Network for Micro-and Nanofabrication) bringing an important contribution to national development of the micro-nanotechnologies.

Keywords: mechatronic research, integronics, nanotechnologies.

SESSIONS
MECHATRONIC SYSTEMS

1. dSpace Platforms for Interfacing Mechatronic Drive Systems

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Abstract: The aim of the paper is to present details regarding interfacing and testing mechatronic drive systems based on different energy sources, using dSpace hardware. The considered platforms are represented by fluidic, shape memory alloy and electroactive polymer actuators based systems. There are studied and pointed out details regarding information flow within the proposed drive systems. The last part of the paper focuses on testing of such mechatronic drive systems, where the shape memory alloy and electroactive polymer based drive systems are considered. The presented approaches are useful components for proper integral education based on mechatronic platforms.

Keywords: mechatronics, pneumatics, actuator, drive system, Matlab, dSpace.

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2. Thermal Modelling and Temperature Control of a House

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Abstract: HVAC (Heating, Ventilation and Air Conditioning) systems used for heating or cooling buildings, consume a considerable amount of energy. To optimize the energy consumption there are important some aspects as: the use of an adequate mathematical model of the building and efficient techniques of automatic control in the regulation of thermal zone temperature and humidity, analysis of the thermal and visual comfort, methods to change behaviour of the occupants etc. As a result it is possible to provide information and suggestions to occupants. This paper presents solutions in modelling, parameter identification and control of the thermal energy in a house.

Keywords: modelling, parameter estimation, control, building, comfort, energy, optimisation.

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3. Influence of Heat Capacity and Thermal Inertia on Heating Control for Reducing Energy Consumption

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Abstract: Thermal comfort inside buildings depends on the response of the building's envelope to the action of outside factors like outside temperature, solar radiation etc. The

increasing number in software environments and analytical methods for building simulation increase the need to compare simulation data with experimental results. This paper presents an experimental model of a detached building equipped with a thermostat, subjected to a day-night temperature cycle. This experiment is a good opportunity to study the influence of the building envelope and its characteristics (i.e. heat capacity and thermal inertia) on improving energy consumption of the building.

Keywords: energy efficiency, energy consumption, thermal inertia, experimental model.

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4. The Evaluation of Absolute Positioning Accuracy of Weapon Barrel Placed on the Mobile Platforms

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Abstract: The paper presents a method to evaluate, by statistical means, the absolute positioning accuracy of a mobile object. The mobile object is posted to a mobile platform. The platform attitude is known based its proper sensors. The mobile object is driven relative to the platform using a command subsystem. The Monte-Carlo simulation method is used based on a mathematical model, which is comprehensive detailed.

Keywords: absolute positioning accuracy, relative positioning accuracy, transducers accuracy, coordinates systems, simulation, Monte-Carlo simulation method, statistics.

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5. The Dimensional Reduction Effect on the Performance of Some Electromechanical Converters

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Abstract: Five types of principial electromechanical energy converters are considered, differing by the energy storage medium (magnetic, or electrostatic) the movement type (rotation, or translation), the force generation procedure (excitation, variable reluctance etc.). It is established the dependency of forces with respect to the scale factor and to the supplying and excitation signals on which natural restrictions are imposed at miniaturization. The dimensional evolutions of forces and of some dynamic performances with the miniaturization process are then comparatively analyzed and conclusions are drawn.

Keywords: electromechanical converters, lagrangean forces, dynamic performance, miniaturization.

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6. DSP Motor Fuzzy Control Application

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Abstract: Nowadays, thanks to the development of microprocessors, brushless motors are widely used in robotics and in the numerical control of machine tools where they have

to perform high-precision positioning operations. In a digital controller of brushless AC Motor, the control accuracy is of a high level, and it has a fast response time. The main objective pursued in this paper is real-time fuzzy control of the rotation speed of a permanent magnet actuator using a control structure (MCK240) produced by Technosoft. To handle the inevitable problem of exponential calculation time and storage-space complexity of fuzzy logic algorithms, fuzzy control method based on Mamdani lookup decision table has been proposed.

Keywords: fuzzy logic control, look-up decision tables, digital signal processor, control performances.

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7. Soft Computing Method for Speed Control of Mechatronic Systems with DC Servomotors

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Abstract: The integration of mechanical systems and electronics in mechatronic devices opens new possibilities for the implementation of new control methods based on soft computing. The speed control of mechatronic systems with electric servomotors is an important task. For the electric drives with DC servomotors the use of soft computing techniques based on fuzzy logic to control their speeds can provide transient responses without overshoots and with minimum time responses. In this paper a fuzzy logic controller with look-up decision tables is proposed to control the speed of a DC servomotor drive. A method of fuzzy rules interpolation in the look-up decision tables is applied. A real time application is successfully implemented.

Keywords: mechatronic systems, Soft computing, Fuzzy logic controller, Speed control, Servomotors, Performance indices.

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8. Electrothermic Carbon Microactuator

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Abstract: This paper provides the first study of the electrothermic behavior of a carbon material based on formic acid-GIC (formic acid-graphite intercalation compound) and presents some electrothermic micro actuator functional structures.

Keywords: actuator, electro mechanic, electro thermal, carbon, acid-graphite intercalation compound, displacement.

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9. Piezoelectric Microgenerators for Body Energy Harvesting

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Abstract: In the Department of Micro and Nano

Electrotechnologies (DMNE) was approached by the "energy harvesting (harvesting)" which included piezoelectric microgenerators (type harvesting) and representing the collection or recovery of energy from the environment and conversion of mechanical energy, acoustic, chemical to electrical energy. Piezolectric microgenerators (type harvesting) are used to power wireless microsensors used for monitoring resistance systems in buildings, or physiological and environmental parameters.

Keywords: microgenerators piezoelectric, energy harvesting, power wireless sensors.

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10. Human Machine Interface and Interaction for General and Special Use

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Abstract: The Human-Machine Interface is where the human meet the machine. It is the area of the human and the area of the machine that interact during a given task. Interaction can include touch, sight, sound, heat transference or any other physical or cognitive function. The paper presents the understanding of the human machine interface and interaction and shows the need to include in design process all the elements which can help the people with disabilities to use it easily. The main goal to attend this is to include in education the human factor in ergonomic human machine interaction.

Keywords: man-machine interface, man-machine interaction, user interface, usability

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11. Intelligent and Autonomous Mechatronics Equipment Used in the Removal of Snow on Secondary Access Roads in the Urban Environment

Diana Mura Badea *, Gabriel Vladut **, Valentin Rotaru, Vasile Brujan**, Catalin Constantinescu**, Doina Bucur***, Sorin Kostrakievici***, Luminita Voiculescu***, Mihail Boiangiu***, Dumitru Vlad*, Eugeniu Condurateanu*, Tudor Guta* and Constantin Petre ***

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Abstract: In this paper is presented the informational system for an autonomous intelligent mechatronic equipment with high autonomy, having GPS and video-cameras to follow-up the route and avoiding the obstacles, using an adequate software to decide, dedicated to be used in eliminating the snow on the narrow roads, avenues and pavements. This equipment transforms the collected snow into ice blocks realizing the optimal conditions for protection and security of the transport. The solution presented in consist in three subsystems (external; driving, monitoring and control; drivers and peripherals devices). The system must realize the functions of navigation, command and control of the electrical acting motors, communications wireless at long distance with the dispatcher and with the system of navigation and communication at short distance with the local system of radio landmark. All this functions will permit to realize the most important target – the active and autonomous identification and avoidance of obstacles.

Keywords: mechatronic, ice block, wireless navigation, GPS

navigation, collected snow.

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12. Equipment for the Automatic and Remote Prescription of the Reference Pressure in National Gas Transportation System Roads in the Urban Media

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Abstract: This paper presents the principal issues to be solved in the design of equipment for automatic and remote regulation of the reference pressure in the national natural gas transportation network.

Keywords: mechatronic system, gas transportation

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13. Active Control of Gears Modulated Vibrations in Mechatronics Systems

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Abstract: The gears vibrations occurring during the operation in the mechatronics systems can be studied in terms of amplitude and/or frequency modulation. These modulations, caused by the meshing teeth forces fluctuation and by the

gears speed angular variation, generate frequency lateral bands that lead to the noise increasing. The paper presents some theoretical and experimental results in order to determine the feasibility of the active control of the gears vibrations in thin bands with/without resonance. In this purpose, it has been realized in/out control system based on an adaptive filter FIR (Finite-Impulse-Response), using the LabVIEW soft. The theoretical studies evaluate the positioning actuators and transducers optimization in the case of a support shaft gear subjected to amplitude and/or frequency modulated disturbances. The experimental results show the efficiency of the active control of these modulated vibrations.

Keywords: modulated vibration, active control, gears, mechatronics systems, actuators

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14. Controlling of a Pneutronic Positioning System without Proportional Equipment

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Abstract: The heart of a pneutronic positioning system is traditionally proportional servo equipment. Unfortunately, such equipment is very expensive. Thus, there is a constant effort to reduce the cost of such systems. The paper gives a general view over two systems for accurate positioning of a workload using a rodless cylinder, without any proportional equipment.

Keywords: pneutronic, precision pneumatics, microcontroller, data acquisition.

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15. Control System for Pneumatic Robot

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Abstract: The paper deals with a control system built for a pneumatic robot with 5 mobility ranks. The robot is controlled using a USB-6009 USB board connected to a PC, along with circuitry needed to adapt the signals. The paper shows how the difference between the number of available DIO lines on the DAQ board and the number of signals needed to control the system is resolved using regularly available integrated circuits and the program developed in LabVIEW to control the robot.

Keywords: pneutronic, precision pneumatics, microcontroller, data acquisition.

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16. Innovative Vectors Mechatronics and Integronics in the Direction of the Development of Education and Research for the Viability of the Labor Market in the Field

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Abstract: The scientific work, developed through an integrated systemic concept, promoting the new science "Mechatronics and Integronics Galaxy" by the global innovative Mechatronics and Integronics vectors as a synergy

of complex engineering structures and the mix-integration of engineering/nano--engineering micro-mechanics, precision engineering/nano-engineering, micro-electronics and engineering/micro-computer nano-engineering in an architectural construction engineering/micro nano-engineering materials, micro-engineering and intelligent systems nano-engineering in an integrative conception similar to the human body, to human behavior and the expression of intellectual, physical and moral, and social human states**.**

Keywords: mechatronics and integronics galaxy, innovative vectors, education, research, micro-nano-engineering.

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17. Modelling of Material Properties for MEMS Structures

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Abstract: The paper presents a combined experimental and theoretical study to determine the actual dynamic Young's modulus ($E_{dynamic}$) for the mechanical structure of a silicon microaccelerometer. The resonance (natural) frequencies of the suspension arms of accelerometer were measured using MSA-500 Micro System Analyzer and, then, introduced in analytical expressions in order to find $E_{dynamic}$. The obtained results were used to validate the model of numerical simulation relative to the measured resonance frequencies of analyzed MEMS accelerometer.

Keywords: MEMS structures, resonance (natural) frequency, dynamic Young's modulus.

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18. Mechatronics and Integronics Galaxy – Basis and Support for Strategic National and European Education, Research and Development

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Abstract: Mechatronics and Integronics Galaxy launches a new integrative science, a new generative and integrative and synergistic concept**,** with an intelligent and adaptive new concept, a spatial and temporal integration, a permanent and predictive flexibility, a simultaneous mix-integrative conception and a technical, technological and ecological strategy for the impact in economics, industry and society.

Keywords: mechatronics and integronics galaxy, generative concept, integrative science; education; research; strategic development.

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19. Hardware and Software Structure of a Pneumo-Hydraulic Positioning System

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Abstract: The paper presents the hardware and software structure of a linear unit for pneumo-hydraulic positioning, developed by the authors. The unit features two identical cylinders, one pneumatic and one hydraulic, mounted in parallel. The speed control is achieved by the use of two check valves of original construction. Mathematical model, simulation results and experimental results are also provided.

Keywords: mechatronics, pneumatics, hydraulics, positioning system, mathematical model.

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20. Using Real Time Simulation for Off-Line Testing of Electro Hydraulic Control Systems

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Abstract: Using the methods of real time simulation of the processes the scientists and technical designers may shorten the period of development of the applications from various fields. These methods offer the possibility of optimization of the functional systems depending on the criteria of performance imposed. The present paper presents a generic application of real time simulation of the electro hydraulic

servomechanisms, developed and tested by the authors of the article in the compartment of general hydraulics of INOE 2000 IHP. This was developed for determining rapidly the dynamic characteristics of the studied servo systems.

Keywords: real time simulation, electrohidraulic servomechanisms.

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21. Using a Smart Camera in Order to Control an Inverted Pendulum

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Abstract: In this paper is presented a method to observe the angle that is made between the pendulum rod and the horizontal axis, using the LabView program and a NI 1742 Smart Camera. Many researchers and designers from different areas as aircraft and spacecraft control, robotics, process control, biomedical engineering, and others have showed over the years an interest in the development and applications of nonlinear control. Systems with inverted pendulum are a good testing and demonstration of techniques for automatic control. Stability of inverse pendulum is a base model to control the walked robots, rocket thrusters, balancing cranes with heavy loads, seismic systems attenuation gravitational waves, etc.

Keywords: inverted pendulum, non-linear systems, design, mechatronics.

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22. Laser Shadowgraph System for the Electrical Arc Investigation

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Abstract: The present article focuses on a methodology and equipment used in metal transfer process investigation, in particular for arc welding processes. The laser shadowgraph combined with a high-speed digital camera technique was applied in order to monitor the filler wire melting and metal droplets dynamics during arc welding process in different conditions and with different parameters. The experimental results obtained after images processing (molten metal drops shape and diameter, drops dynamics and velocity) in different phases of the process can be used for the welding metal transfer modeling, modern power supply control algorithm development and new filler metal development and gas testing.

Keywords: laser, shadowgraphy, arc welding, HDRC, camera, image processing.

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23. Temperature Control of an Electrical Heater by Using Fuzzy Logic

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Abstract: This project will be done in collaboration with Friedrich Schultze Company, Siegen, Germany. The aim of the project was to develop the intelligent switcher for industrial

heaters to detect the interfacing object placed on a ribbed radiator and to fulfil the standard EN60335-2-30. The focal point of this work contained an intelligent algorithm and basic electronic design for sensing temperature inorder to ensure safe working of an electric heater. The fuzzy logic technique will be used to develop the intelligent "switch off" algorithm. The tests were performed by different types of heaters.

Keywords: fuzzy logic, fuzzy sets, fuzzy rules, electrical heater, temperature control

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24. RFID Technology Used in Small Library - Case Study at Transilvania University

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Abstract: The paper summarizes the authors' concerns regarding the development of a mechatronic system with application in automation and management of the small libraries. The proposed system provides a combination of Koha open source integrated system with RFID technology in order to achieve an economical solution with large applicability.

Keywords: automation, mechatronics, RFID, library, integrated system.

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25. Integrated Mobile Solutions for Law Enforcement and Emergency Medicine

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Abstract: Gemini Robotics aims to provide a new and innovative solution for today's law enforcement and emergency medicine specialists. By using biometrics the device shown below makes for a quicker and more efficient gather of information from a person. Thanks to the components used, it has become possible to gather all types of biometric data (fingerprint, facial recognition, vocal analysis, code reader) from a single device that also replaces the needs for other devices that burden these specialists.

Keywords: architectures, authentication, biomedical system, communication systems, medical applications, real-time expert systems, systems concept.

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26. Specified Settling Time and Peak Time Multimode Vibrations Suppression Compensator Design for Mechatronic Systems

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Abstract: This paper presents a method of designing vibration suppression compensators to obtain specified dynamic performance compensated systems. As timing is a high

concern in fast and accurate mechatronic systems, keeping the undesired residual vibrations under control is an important task. The method in this paper aims providing a system output that obeys a specified settling time and a specified peak time concomitantly. The method requires a second order transfer functions based representation of the multimodal behavior of the original system and a custom designed reference model to embed the dynamic performance requirements. A description of the continuous time design algorithm is provided along with a numerical example.

Keywords: vibrations suppression, compensator design, settling time, peak time, mechatronic system.

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27. Theoretical and Experimental Research of Mechanical Amplification Structure Displacements Performed by Piezoelectric Actuators

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Abstract: The paper presents the investigations results of five mechanical structures designed and manufactured to amplify displacements produced by piezoelectric actuators. Among the equipments that creates interfaces between mechanics and electronics, piezoelectric actuators provide the best performance in terms of driving forces and working frequencies. This type of actuators can be found in many mechatronical systems, like electro-mechanical converters as proportional electromagnet, electric micromotor (stepper, DC or AC), and torque actuator type. Their great disadvantage is the small displacements produced. For reasonable dimensions of the primary piezoelectric element (disks stack or layers stack) of 10 … 50 mm the displacements produced by them

are only of 10 … 50μm. The technical requirement to amplify such small displacements results from a practical application: a mechatronical system that requires displacements of 0.8 …1.2mm and actuating forces of 40…60N.

Keywords: electromagnetic converter, displacement amplification system, piezoelectric actuator, compliant mechanism.

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28. Mechatronic System Used for Flow Controlling of Hydraulic Pumps with Axial Pistons

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Abstract: The paper aims to emphasize the main technical performances of the mechatronic system designed in order to control the flow of hydraulic pump with axial pistons. The control method is a continuous one and refers to a very accurate positioning system with mechanical feed-back. By solving the mathematical model of the entire system with dynamic conditions, we have concluded that the theoretical piston displacement is inside an acceptable range. This could be a method for improving the efficiency of the hydraulic pump and of the actuated system too.

Keywords: control system design, feed-back systems, electro-hydraulic systems.

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29. Real Time Equilibrium for Inertia Forces in Precise Hydraulic Driving Systems

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Abstract: In the first part of this paper, mechanic and hydraulic parameters are analyzed, which are involved in precise driving hydraulic systems and with respect to the actual flow adjustment performances, the possible displacements with slow and fast velocities are established, both with direct implications in the dimension of the inertia forces and precision positioning. The second part presents an original study for the real time equilibrium system for the inertia forces by creating pressures on the hydraulic resistances present on the evacuation circuit in the hydraulic cylinder, pressures installed faster than those in the input powering system for the cylinder, with time adjustment ensured by modulating the command impulses of resistive valves. A mathematical model for the proposed balancing method is shown in the final part of the paper, with an application example for a precise driving hydraulic system, with real hydraulic equipments, analyzed and calculated for actual values.

Keywords: precise positioning system, positioning error, inertia forces, limit parameters, real time equilibrium.

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30. ZigBee Wireless Network Based Monitoring Systems

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Abstract: Applications that transfer data wirelessly tend to be more complex than wired ones. Wireless protocols make stringent demands on frequencies, data formats and timing of data transfers, security and other issues. Application development has to consider the requirements of the wireless network in addition to the product functionality and user interfaces. Using wireless networks in Mechatronics can be very useful and challenging in order to improve the general performance. The authors studied the opportunity of setting up Monitoring Systems based on a ZigBee Wireless Network Standard. The proposed systems were set up, tested and the minimal Hardware and Software requirements for them were determined.

Keywords: wireless network, ZigBee, monitoring system, mechatronics, I^2C communication, microcontroller, humidity and temperature, vending machines.

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31. LifeMOTE - Decision-Parametric System for Health Telematics. General and Hardware Aspects

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Abstract: Collecting information about the health status of patients' offers a lot of advantages. This can be done in hospitals, medical offices or special laboratories where the patients come for the investigation of different diseases. Information acquired is useful for establishing a diagnostic, but most times they are current values reflecting the health status from that moment. Unfortunately, there are many diseases that require a long time monitoring of physiological parameters for having an overview of the health status of the patient, during different types of activities and for identifying the right diagnostic. There are also many cases when the vital parameters have to be monitored in real-time and if some of them exceed the normal limits an immediately alarm has to be triggered, allowing the first aid team to locate the patient and intervene in the shortest time. This paper presents general and hardware aspects for a health telematics system for remote monitoring the patients' health status information. The software aspects regarding management of patients' information will be presented in a distinct paper. Acquiring data, local storing and/ or sending to a server, analyzing them in real-time based on some parametric rules, all of these are important steps for the system to decide about the health status of a patient and announce any problem that may rise.

Keywords: monitoring, health, telematics, telemedicine, patient, remote, physiological, bio-medical, instrumentation, bio-mechatronics.

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32. LifeMOTE - Decision-Parametric System for Health Telematics. Software Aspects

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Abstract: Collecting information about the health status of patients is a demand for establishing a diagnostic. This can be done in hospitals, medical offices or special laboratories where the patients come for the investigation of different diseases. There are also many cases when the vital parameters have to be monitored in real-time and if some of them exceed the normal limits an immediately alarm has to be triggered, allowing the first aid team to locate the patient and intervene in the shortest time. The monitoring process is realized with special portable equipment attached to the patient's body. Acquired data can be locally stored and/ or sent to a server, for having a time evolution and a history of them. A real-time analysis can also be done based on some parametric rules, so that to instantly decide about the health status of a patient and announce any problem that may rise. This paper presents a brief hardware description of the system and detailed software aspects regarding transfer and management of patients' information. The general and detailed hardware aspects for the health telematics system for remote monitoring the patients' health status information are presented in a distinct paper.

Keywords: monitoring, health, telematics, telemedicine, patient, remote, physiological, bio-medical, instrumentation, bio-mechatronics.

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33. Soil Humidity Modeling for the Design of a Decisional Support Mechatronic System in Precision Agriculture

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Abstract: Correctly evaluating the fertility of a certain land lot has always been a major concern for the farmers and the entities involved in precision agriculture. Present technology typically implies the use of fertility maps as a means of assessing fertility levels of different land lots, with a large focus on the mapping of soil electro-conductivity, thus offering only a general assessment of the fertility of the analyzed soil. By using a new concept of integrating soil specific parameters within GIS based mapping systems one can track the fertility of the soil relatively to bio-environmental factors like temperature variation, soil humidity, light radiation quantity, and soil nutrient concentration. It is the purpose of this paper to discuss the process of tracking soil humidity relative to the proposed mechatronic system.

Keywords: soil electrico-conductivity, humidity sensor, integrated system design, precision agriculture.

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ROBOTICS

1. A Method for Forward Displacement Analysis of 3-RRP and 3-PRP Planar Parallel Manipulators

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Abstract: The paper presents a method for the forward displacement analysis of 3-RRP and 3-PRP planar parallel manipulators including the RP-RP-RP third-class Assur group. The aim of this analysis is to find all possible configurations of the parallel planar mechanism for one given set of input joints values. The proposed method leads to a non-linear system of three equations with three unknown parameters. Using a successive elimination procedure, a polynomial equation of eighth order in one unknown is obtained. The real solutions of the polynomial equation correspond to the assembly modes of the planar parallel mechanism. The maximum number of the assembly modes of the investigated manipulators is two. Furthermore, a numerical application of the proposed method is presented.

Keywords: planar parallel manipulator, forward displacement analysis, Assur group.

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2. Spatial RRR Robot Manipulator Optimum Geometric Design by Means of a Hybrid Algorithm

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Abstract: In the present paper an optimization algorithm to find out the geometric design parameters of an open loop spatial robot with three revolute joints is described. The design variables include the base position, the geometry of the links and the joint angles of the robot and are calculated so that the manipulator will be able to place its end-effector at prescribed poses, avoiding simultaneously singular configurations. The developed algorithm uses the Denavit-Hartenberg parameters and 4x4 homogeneous matrices to obtain the kinematic equations of the robot. The optimization problem is solved with a hybrid method that combines a genetic algorithm, a quasi-Newton algorithm and a constraints handling method. To examine the efficiency of the method, numerical examples for one, three and five prescribed poses of the end-effector are applied.

Keywords: geometric design, genetic algorithm, optimization method, robot manipulator.

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3. State-Based Conceptual Design in Mechatronics via Petri Nets: A Case Study for an Educational Robot

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Abstract: Use of state-based models to represent artifact behaviors at conceptual design is a challenging area for design research. Conceptual design of mechatronic systems needs a multi-domain approach in which the "logical behavior" of a mechatronic design artifact is described without any physical realization. This paper presents a case study on state-based representation for the intended behavior of a non-existent robot at early conceptual level. The behavior is defined through a demonstrative scenario and represented as states and state transitions independent of any physical embodiment. Discrete Event System Specification (DEVS) and Petri Net formalism are used for the model. This representational model is first step towards the development of a virtual prototype for the logical behavior of robot design.

Keywords: state-based design, Petri Net, conceptual design, mechatronics, educational robot.

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4. Biological System Analysis in Bioinspired Conceptual Design (BICD) for Bioinspired Robots

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Abstract: Bioinspired design (BID) provides a systematic way for bioinspired applications. Although several BID approaches as well as some tools and databases are available in the literature, the studies on BID are still challenging for designers and/or engineers because of limitations of current BID approaches. There are mainly two directions related with these limitations. One of them is the representation of knowledge on biological systems and the second is the problem of transforming this knowledge into engineering domain. These limitations expose two questions; firstly, "What knowledge is required to describe biological systems?" and "How this knowledge is represented?" and secondly, "How this knowledge is transformed into the engineering domain?". This paper presents a study which aims to answer the first question about knowledge required to represent biological systems. This knowledge is obtained during "Analysis of Biological Systems" stage of a new suggested bioinspired conceptual design (BICD) procedure.

Keywords: bioinspired design, knowledge of biological systems, biological system analysis.

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5. A Novel Approach to Master and Slave Control by Force Feedback Based Virtual Impedance Controller

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Abstract: A field of research which deals with tactile sensation is called haptics. Many researchers have been investigated haptics in recent years. In the past research, 4ch bilateral controller based on torque/force sensorless approach is developed so as to achieve high transparency as teleoperation systems. In actual system with geared motor, however, the high transparency leads to instability because of disturbances. In particular, the geared motor has a large joint friction which affects the torque/force sensorless control, though its cost is low. This means that the high quality of tactile sensation is not expected in case the geared motor is used in experimental system. To improve the effect of friction, linear motor is often utilized in the past research, though its cost is high. To address this issue, this paper focuses on a novel control strategy to realize low cost teleoperation systems based on the geared motor, that is, master and slave systems. To reduce the effect of joint friction, a novel approach to master and slave control by force feedback based virtual impedance controller is proposed. By using the proposed method, position and force controllers can be designed independently and it is one of remarkable features. To verify the validity of proposed method, the performance of the controller is analyzed and evaluated by using "Reproducibility" and "Operationality". Furthermore experimental validation is conducted with 1-DOF manipulator.

Keywords: master and slave system, Force feedback, Virtual impedance control

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6. Driving Modules with Adaptable Structure for in Pipe Inspection

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Abstract: This paper presents five drive modules with adaptable structure developed by the authors. These modules can adapt to the inner diameter of the pipe they are inspecting. They can be used independently as inspection and exploration minirobots or they can be part of a modular inspection system. Three such modular systems, which contain the first three prototype modules, are presented in the second part of the paper.

Keywords: mechanisms, mobile robots, drive modules, passive modules, inspection, systems.

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7. Vision Based Autonomous Navigation in Unstructured Static Environments for Mobile Ground Robots

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Abstract: This paper presents an algorithm for real-time vision based autonomous navigation for mobile ground robots in an unstructured static environment. The obstacle detection is based on Canny edge detection and a suite of algorithms for extracting the location of all obstacles in robot's current view. In order to avoid obstacles we designed a reasoning process that successively builds an environment representation using the location of the detected obstacles. This environment representation is then used for making optimal decisions on obstacle avoidance.

Keywords: autonomous robot, robot vision, image processing algorithms, unstructured environment, Canny edge detection, agglomerative clustering.

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8. Nanorobotic Systems for Nanomanipulation and Nanopositioning

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Abstract: Nanorobotics is currently a much studied field by the international scientific world. Numerous applications of nanorobotics make it to expand in several areas. This occurs through the integration of several disciplines, including nanofabrication processes used to produce nanorobots, nanoactuators, nano-sensors and nanometer scale physical modeling. Some of the most important applications of nanorobotics are nanopositioning and nanomanipulation.

These, in turn, find many other applications to produce different MEMS/NEMS systems, in materials science, biomedical sciences, engineering sciences, etc. Taking into account the importance of this field, we wrote this review in order to present a part of actual nanorobotic systems technology.

Keywords: nanorobotic nanomanipulators, nanorobotics, nanosystems, nanopositioning, hexapod positioning system

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9. CAD Design and Analytical Model of a Twelve Bar Walking Mechanism

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Abstract: This paper presents a general approach to design of walking robot based upon aspects regarding mechatronic environment such as CAD design. The analytic model and simulation of the walking mechanism that is used for building a walking robot structure is also described. The vector loop and simple geometric method are used for studying forward kinematics.

Keywords: mechatronics, CAD design, walking robot, kinematics, vector loop

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10. Design and Control Aspects of a Climbing Robot with Vacuum Cups Attachment System

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Abstract: The paper presents some design and control aspects of an autonomous mobile robot, which moves on horizontal and vertical surfaces using an electro-pneumatically vacuum cups attachment system. The original robot construction, developed as a cleaning robot, includes two triangular platforms that provide a light weight. The system modelling and simulation were performed by means of SolidWorks – Cosmos Motion software package. The control is obtained with the motion data acquisition board 7344 from National Instruments and LabView programming support.

Keywords: climbing robot, cleaning, vacuum cups, pneumatics, robot design, mechatronics concept.

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11. A Method for Determining the Trajectory Characteristics of Industrial Robot

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Abstract: The paper presents a synthesis of the main characteristics of industrial robots and proposes an original

method for determining the trajectory characteristics of the robots. The sensing system is described including the electronic block diagram. The application software used to determine the trajectory characteristics is presented.

Keywords: trajectory, sensing system, position determining.

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12. Rapid Prototyping on an Omnidirectional Platform using Lego Education Components

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Abstract: This paper describes the advantages of a new learning method, called learning by doing or learning by experiments. The learning by doing concept shows the increasing improvements that this simple idea can bring by permitting students to practice and carry out projects that puts their innovations and creativity at work, making classes fun and more interactive. In this case, one of the most efficient methods of learning is working with Lego Mindstorms NXT during classes. Because of its modular structure, students are able to create their own prototypes for robots and implement the program they make in the Lego NXT controller. The first part of the paper presents several projects made by students during semesters or for their final paper, such as robots architecture and their implemented program.

The second part of this paper presents a study on an Omni-directional platform. A working prototype has been realized using Lego education components. Rapid structure prototyping and rapid control prototyping desiderates are presented as well as the in-depth kinematic analysis. The obtained equations are implemented for the prototype's controller using NXT-G, a graphic programming language. A remote control is design

using a NXT controller and a 3-axis accelerometer. The combination of the Omni-directional platform and the remote control is tested.

Keywords: mechatronics, rapid prototyping, lego, learning by doing.

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13. Design, Simulation and Control of Isoglide T3R1 Parallel Robot

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Abstract: This paper presents a parallel robot with four degrees of freedom. The Isoglide T3R1 parallel robot is a robot with decoupled motions. In this paper will be presented the design, simulation and the control of this robot using Matlab/Simulink and Matlab/Virtual Reality

Keywords: simulation, design, control, Isoglide.

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14. Optimization of the Control for the RV-2AJ Serial Robot

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Abstract: The paper presents the dynamic behaviour of a RV-

2AJ serial robot and also the optimization of the control with the numerical results for some operating conditions. In accordance with the robot arm dimensions geometrical model is obtained using a CAD environment. Each component of the robotic arm was modelled and then the virtual parts were assembled forming the virtual geometric model of the robot. To simulate the behaviour of the robot arm, the model is exported into Matlab. Some modifications were brought to the model generated, and some additional items were inserted in the model in order to control it and to analyze it. Finally, numerical results were provided in order to show the effectiveness of model.

Keywords: geometrical model, simulation, virtual reality, control optimisation.

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15. IMU (Inertial Measurement Unit) Integration for the Navigation and Positioning of Autonomous Robot Systems

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Abstract: An autonomous robot needs to be able to position itself in a given surrounding environment and to be able to accomplish a given navigational goal. This paper presents the integration of an Inertial Measurement Unit for the navigation and localization of an autonomous robot system. A generic control architecture is used for the CoRoBa architecture, using servant object component interfaces like *Sensor, Processor,*

and *Actuator*, inherited from the Service interface abstraction based on the TAO implementation of the communication middleware CORBA. Different data integration modes were overviewed using several Kalman Filter implementations. The integration process for the Microstrain 3DM-GX2 IMU and the robot localization were designed for the ROBUDEM robot platform, and implemented as CoRoBa *sensor* and *processor* modules.

Keywords: autonomous, IMU, localization, CORBA middleware**,** navigation

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16. A Test Bench to Study Bioinspired Control for Robot Walking

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Abstract: Test bench to study robot walking within the predicted structures of biological control systems is discussed. Physical system is briefly presented with components. Kinematic model and evolutionary way of gait generation for the leg structure in test bench is discussed. Different forms of gaits can be found by genetic optimization using patterns formed by central pattern generators.

Keywords: bioinspired control structure, central pattern generator, robot walking, evolutionary gait generation

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17. Testing of a Mechatronic Inspection System's Prototype

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Abstract: The aim of the paper is to investigate some of the most important parameters of an inspection mechatronic system and to test the developed prototype for validation purpose. In the introduction of the paper some important details about the inspection mechatronic systems are presented. In the second part the developed prototype along with the test conditions are presented. In the third chapter theoretical aspects about the locomotion of the system inside pipelines are discussed. Test condition and results are presented in chapter four and five of the paper.

Keywords: pipeline inspection, mechatronic system, prototype, test, validation.

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18. Matlab Simulator for Gravitational Stability Analysis of a Hexapod Robot

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Abstract: In this paper the authors present a software program to simulate hexapod robot stability in gravitational field for a certain configuration of legs using Matlab software package. The simulation software was created using geometrical

modelling based on Denvait-Hartenberg algorithm and analyses the static stability of the robot in different stages of locomotion on horizontal surface for different leg configuration. The paper includes some experimental results related to the static gravitational stability depending on the support polygon formed by the legs on the ground.

Keywords: Matlab, gravitational stability, Denavit-Hartenberg representation, model, hexapod.

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19. Design and Experimental Research of an Original Construction of Rolling Robot with Extending Legs

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Abstract: The paper presents several important results of the experimental research performed in order to test the viability and the behavior of a novel construction of rolling robot developed by the authors. The innovative design of the robot and its operation mode are also presented.

Keywords: mobile robots, magnetic couplings, rolling, dodecahedron

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20. Development of a New Harvesting Module for Saffron Flower Detachment

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Abstract: The paper deals with the development of a new module for the detachment of the saffron flower. The module is conceived to be a part of the Agri-robot Zaffy. The module is composed of a gripper, a vision system, a pneumatic system for leaves shifting and a suction system for the harvesting of flowers after detachment. This paper describes the design of the module, with a special focus on the gripping device and on the vision system. The paper also shows the prototype of this module and the experimental activity performed in our research laboratory in order to measure the detachment capability and to test the vision system performances. Finally a preliminary experimental test was conducted in a Crocus cultivation. The preliminary results obtained show that the vision system has some critical positions in detecting the saffron flower.

Keywords: automated harvesting, saffron flower, mechatronics design

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21. Hybrid Micro-Nano Robot for Cell and Cristal Manipulations

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Abstract: The paper presents some Computer Assisted Engineering (CAE) aspects concerning the achievement of a hybrid actuated micro-nano robot. Starting from a unitary concept Control- Design, different kinematic solutions were developed and compared, before a decision upon the structure was selected. Multiple closed loop simulations were performed via MATLAB/Simulink, Solid Dynamics and ANSYS software. The experimental results for the nano-stages/actors were run for two XY orientations with a range of 240 arcsec while and for translation in Z direction in a stroke range of 65µm, and system resolution of 10nm. Additional identificationand reconstruction of the hysteresis curves were obtained and implemented in the model by using a Neuro-Fuzzy technique. Two hardware systems were developed for the micro and nanorobot respectively. Corresponding software HMI capable also of joy-stick telemanipulation was developed.

Keywords: robotics, micro and nano actuation, piezo drive, position and speed control, HMI, mathematical modelling, modelling and simulation, solid bodies.

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22. Increasing the Position Tracking Accuracy of an Autonomous Mobile Minirobot, an Essential Condition for the Remote Command and Control of the Motions

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Abstract: In the paper there are presented the results of an applicative research whose object was to increase the position tracking accuracy of a crawler mobile minirobot. Both the minirobot's position tracking in the operating space and the commands of the electric micromotors for driving the active wheels causing the motion, are made via remote control by two main components of a complex automated command system, an optoelectronic installation for position tracking a luminous mark on the minirobot, respectively a control system of a virtual minirobot – a counterpart of the real one in a virtual space. The communication architecture and the used technologies, created the possibility to control the minirobot without using physical connections both locally, and remotely via the Internet. The improvement of the minirobot's position tracking performance proved its efficiency through the correctness of the de command decisions for the trajectories and also through the correctness of their execution.

Keywords: autonomous mobile minirobot, position tracking equipment, optoelectronic sensor,

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23. Adaptive Control of a Virtual Mini Robot with Autonomous Displacement Using a Virtual Sensor System

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Abstract: The paper presents the latest version of a family of optoelectronic sensors used for the control of mini robots without embarked sensors. The optoelectronic sensors are based on the concept of virtual sensor. The last section of the paper focuses on the technical solution developed for the transfer of the light source attached to the mini robot on the tracking and control equipment, using a laser directed to a reflecting sphere attached to the mini robot.

Keywords: optoelectronic sensor, virtual sensor, rotating mirror, stereoscopic base, mini robots.

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24. Locomotion and Reconfiguration of a Modular Robotic Chain

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Abstract: The paper deals with a modular robotic system, which is designed for reconfiguring, in order to achieve both walking and crawling locomotion. Its mechanical architecture and control system are presented. A modified robotic module, with 2 degrees of freedom, is proposed, for which the

influence of the robot geometry upon the locomotion and self-reconfiguration strategy is pointed out, by simulations performed in a virtual environment.

Keywords: modular robotics, autonomous system, distributed control, self-reconfiguration, self-replication.

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BIOMECHATRONICS AND MEDICAL INSTRUMENTATION

1. Design and Testing of Two Mechatronics Systems for Robotized Neurorehabilitation

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Abstract: This paper illustrates the design and the testing of two mechatronics prototypes useful for robotized neurorehabilitation and for motor training assessment. The two machines are called Bra.Di.P.O. (Brain Discovery Pneumatic Orthosis) and P.I.G.R.O. (Pneumatic Interactive Gait Rehabilitation Orthosis). They are electro-pneumatically controlled. This allows to obtain a lot of advantages: pneumatic systems give comfortable interaction between machine and patient; they are safe, clear and easy to connect to hospital plant; they are MR-compatible. These prototypes have been tested both in laboratory and at hospital and results obtained are good.

Keywords: medical pneumatic devices, fMRI analysis devices, pneumatic active exoskeletons, neurorehabilitation robots, mechatronics devices for lower limbs rehabilitation.

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2. Basic Concepts in Design of Biomechatronical System for Knee Joint Rehabilitation

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Abstract: This paper presents the basic theoretical biomechatronical concepts used to conceive a new rehabilitation system for the knee joint. The recovery therapy is necessary after some local injuries are affecting the normal functionality of the joint and lower limb. The rehab biomechatronical system should be used to allow patients to achieve adequate knee flexion, extension, internal and external rotations. Using the mechatronical system in the physical therapies, after local accidents, involves improving the quality of therapy because of their advantages: ensure repetitive exercises, can assist and restore the range of motion, can be programmed and perform a wide range of exercises customized for each patient and also can replace the physiotherapist.

Keywords: biomechatronics, knee joint, mechatronics, rehabilitation, lower limb, biomechanics.

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3. Intelligent Mechatronic Technology for Tribological Characteristics Improvements of Hip Prostheses Using Nanomaterials Coatings

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Abstract: The main objectives of this project are to study and to improve tribological properties of hip prostheses and to increase the life span of joint implants. The methods and instruments for this development are taken from different branches of science and technique: through incorporating nanostructurd coatings in the design and increasing the wear resistant functions of natural joints. Hip prostheses may be used for different periods of time, depending on their composition and mechanical properties. They deteriorate due to the high superficial pressures produced by mechanical movements of the body.

Keywords: biomedical systems, mechanical systems, medical applications, tribology, nanomaterials, atomic force microscopy

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4. Lung Ventilators Parameters Determination

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Abstract: An integrated test unit that can automatically determine the ventilators parameters provided by pulmonary ventilation equipment is being developed. Several sensors mounted to a computer via a data acquisition card are used for automatic determination of the parameters. A program that can automatically extract the ventilator's parameters is developed using the LabView software.

Keywords: ventilation parameters, test system

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5. Comparative Study of Mechanical Fixation of Extreme Distal Femur Fractures with Plates and Condylar Intramedullary Nails

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Abstract: Two models of condylar plates and two of

intramedullary nails have been tested using synthetic femurs manufactured by SYNBONE AG Company, for determining the behaviour to mechanical stress similar to that in-vivo. Three types of supra/intercondylar fractures were simulated and the bone-implant constructions have been tested statically and dynamically, measuring the total maximum displacement, fracture gap changes and achieving a statistical analysis of the four models of implants.

Keywords: supra/intercondylar fractures, condylar plates, intramedullary nail, static/dynamic testing.

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6. The Validation of Mechanostat Theory in the Case of Pertrochanteric Fractures Assisted by External Fixed Implants

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Abstract: The Finite Element Analyze is used in this paper for analyzing the evolution of stress and strain field in a fractured femur, provided with a fixed implant at the proximal end (femoral head). The purpose of the study is to validate the mechanostat theory in the fracture region. The most favourable region for bone consolidation is determined in the fracture face considering as parameters the shape of the implant on two variants and the contact type between the implant and the bone also in two variants. The conclusion of the study stresses the idea that an active attitude of a patient can stimulate the consolidation of the fractured bone, due to the stimulation of the bone growth in the fracture surface.

Keywords: FEA, strain field, pertrochanter fracture, femur implant.

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7. Aspects of Contact Region Between Bone and Implant for Different Endoprosthesis Types

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Abstract: The paper presents some interesting aspects of the contact between the bone and the implant in case of different types of endoprosthesis. This comparative study is made for different types of stems. The models for the femur and for the stems were obtained in ProEngineer and the analyses were solved in Ansys. The introduction of finite element analysis (FEA) into orthopaedic biomechanics allows continuum structural analysis of bone and bone-implant composites of complicated shapes. Mechanical adaptation influences the success of many orthopaedic treatments, especially total joint replacements**.** A good contact between the bone and the stem indicates a long life solution for an endoprosthesis. A personalized stem is very useful for persons with disabilities. The contact results from Ansys illustrate the aspects from the bone – stem interface. With this information the orthopaedist may take a good decision for a proper hip joint endoprosthesis used for a named patient.

Keywords: total hip arthroplasty, computational model, hip prosthesis, finite element, modelling, stem.

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8. Total Disc Prostheses for Lumbar Spine: A Systematic Review of the Literature

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Abstract: In the present time degenerative disc disease in the lumbar spine has a high frequency and often this is the cause of the low back pain. Surgical treatment for degenerative disc disease has consisted of lumbar fusion for a long time; total disc arthroplasty for lumbar spine has been proposed and improved as an alternative method for lumbar fusion. Total disc prosthesis is an artificial device that replaces degenerated disc and preserves the intervertebral motion. The objective of the present study is to evaluate the behaviour of the total disc replacement on lumbar spine in comparison with lumbar fusion. Fusion technique eliminates all motion in a functional spine unit, while total disc arthroplasty affects the facet joints during physiological spinal movements. The total disc replacement appears more attractive than vertebral fusion for young people who practice intense physical activities or sports.

Keywords: low back pain, lumbar spine, intervertebral disc disease, lumbar fusion, total lumbar disc prosthesis, total disc replacement, spinal arthroplasty.

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9. Experimental Determinations of the Round Reaction Force Depending on the Characteristics of Sole Materials and Ground Surface

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Abstract: Ground reaction force occupies an important place in the overall context of human motion analysis. It is also an indicator depending on both the geometric shape of the curve and the variation of the point of force application on the foot plantar, so that specialists can quantitatively and qualitatively evaluate a form of pathological gait. There is a considerable body of evidence to support the hypothesis that transient forces, transmitted through the skeleton, are harmful.

The body's reaction to changes in footwear – whether they are shoe modifications and inserts or orthopedic corrections – depends on the time period within which a particular type of footwear is used. In fact, the biomechanical effects of changes in footwear must be differentiated according to the time needed for the body to adapt to these changes.

The purpose of this study was to determine the ground reaction force depending on the characteristics of the materials used for the sole in normal gait on different types of ground surfaces.

Keywords: ground reaction, force plate, biomechanics, footwear.

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10. Types of Hip Prostheses Available Today

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Abstract: Hip replacement or hip arthroplasty is today a common and highly successful a surgical procedure. The numbers show that the success rate is more than 97% and the revision rate (Revised means that the operation has to be repeated) of 10-15%. However regarding the number of revisions there are noticeable differences between different types of prostheses. This paper describes the types of prostheses for total hip arthroplasty and types of prostheses for other hip operations.

Keywords: hip prostheses, customised prostheses, prostheses materials

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11. Modeling and Simulation of the Eyeball Optical System

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Abstract: The paper presents the results of modeling and simulation of the eyeball optical system and proposes a method of computing an interpolation polynomial that would

allow modeling and simulation of the variation of the crystalline lens refraction index for the eye at rest and for the fully accommodated eye. This stage is compulsory for the calculus of aberrations of the eyeball optical system and represents the basis of the course "Visual System Modeling", taught to the students of the 1st year of Master.

Keywords: technical optical system, biological optical system, interpolation polynomial

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12. Self Calibrating Wearable Active Running Asymmetry Measurement and Correction

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Abstract—We present a novel self-calibrating wearable device to improve running training by active vibro feedback. The system consist of a pair of spandex shorts which embed a processor unit, 4 accelerometers, 2 vibro motors, a SD card reader\writer module and a real time clock. The accelerometers are located on the shoes and in proximity of the knees and are used to measure in real time tri-axial accelerations. We present an algorithm to compute asymmetry from the 3 axial sensor data. The main novelty is the auto calibration algorithm which uses principal component analysis on each sensor based on kinematic assumptions. The system provides two important advantages: data logging and real time active correction. The active correction is performed in real time by signal sent to the user during via rumble feedback. The vibration signal is sent to the specific leg and its intensity is related to the entity of required correction. This approach to running training is very useful to athletes and to sport medicine in order to improve speed, posture, fatigue and reduce joints osteoarthrotic

problems.

Keywords: running training, active posture correction, wearable wireless device, vibro feedback.

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13. A Wired Actuated Elbow for Human Prosthesis

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Abstract: The mechatronic solutions used in robotic field are more and more used in other areas. Conspicuous research teams are working on arm prosthesis, investigating and developing new mechanical architecture and actuator. The mean aspect is to set up mechanical devices, actuators and energy supply. This paper presents a new mechanical elbow to install on artificial arm for human prosthesis. The device is based on 3 hydraulic actuators connected through some wires to the following forearm components. A complex and optimized path of wires makes actuators work with almost constant linearity between extensions of pistons and flexion-extension and pronation-supination angles. A kinematic 3D virtual model is presented at a second step of geometrical optimization. The authors decided to use redundant actuators, 3 instead of 2, to modulate the mechanical compliance of the artificial arm depending on the kind of operation the patient will wish perform. Moreover, in parallel, the authors are working with the third piston that collaborates with the others to optimize the volume and minimize the stresses.

Keywords: robot arm, human reliability, tridimensional mechanisms, hydro-pneumatic actuator, biomechanics.

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14. On an Orthesis for Damaged Ankle Articulation

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Abstract: The paper present an application to be used it further studies on different patient locomotion stability presenting foot drop caused accidentally or by neuro-motor dysfunction, under variation of environmental influence factors connected to specific activity areas. In its first part we refer to biomechanics of standing, walking and running planes of motion followed by some consideration on normal and pathologic ankle as a consequence of a sprain. The obtained product presenting a lot of advantages is very cheap and elastic in use for multiple applications.

Keywords: human locomotion, ankle, sprain articulation, foot drop, orthesis**.**

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15. Influence of Ergonomic Conditions on Locomotors Health

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Abstract: The present paper is a review of the influence of the ergonomic conditions on locomotors health, especially regarding the low back disorders during different occupational

activities undertaken in different types of environment. The ergonomic conditions that might be considered as influences to the low- back disorders are: heavy physical work, lifting and forceful movements, bending and twisting (awkward posture), whole body vibration (WBV) and static work postures. All this conditions subject the spine and especially the low-back part to different types of stress, as it is exposed in the paper. The main issues are viewed from a biomechanical point of view as well as from clinical and experimental results.

Keywords: ergonomics, biotechnology, low- back, disorders, posture, vibration, occupational, load.

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PRECISION MECHANICS SYSTEMS

1. Considerations Regarding the Adjustments Settings of the Functional Parameters for the Helical Compressors

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Abstract: The experimental researches were undertaken by a complex team of engineers in order to determine the optimal regulation of the functional parameters in the helical compressors. The helical compressors called "screw" are compressor with "rotary piston" consisting of two shafts. The compression is done continuously by rotating the two rotors. Since the screw compressors have pure rotating masses, they meet in many respects the advantages of the turbo machines, namely the high speed and the absence of inertial forces. The screw compressors are used, especially in the petrochemical industry due to the low weight and the small size combined with the high efficiency. The high capacity does not decrease the service life parameters because the work area does not contain any component susceptible to wear by friction. The operating parameters were experimentally measured on an air compressor with screw compressor and the flow control of compressed gas was performed in a optimized mode. After experiments the optimization of the screw compressor operation was performed considering the vibration levels of the machine. Thereby, a regime with small amounts of vibration was found, so that the service life time until the repair operation increases.

Keywords: compressor, tests, vibration measurement, parameters, speed, efficiency.

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2. Considerations Regarding Ecological Aspect through Petroleum Waste Separation in Components

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Abstract: The paper deals with the analyses of new method, proposed by authors, which is referring to the usage of a separation installation through centrifuge separation of water based on centrifugal force and on density difference of the three components.

Keywords: prevention, design, numerical simulation, water.

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3. System with Special Geometry Used for Magnetostatic Treatment of Fuel Fluids before Burner

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Abstract: Worldwide it is strongly felt the appearance of some improved burners with low emissions, and there is a major concern of informing and linking the European research during international programs, at which Romania takes part, through which it is wanted the implementation of these modern

systems of producing electrical and thermal energy, with a high efficiency level and in terms of maximum environmental protection. In accordance with these worldwide requirements and regulations, our team has designed and built a device for magnetostatic stimulation of combustible fluids, downstream the burner, used for improving the performance of the traditional burners, which does not use an auxiliary source of energy.

Keywords: magnetic stimulation, paramagnetic, fuel fluids, flow rate.

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4. Theory and Simulation of Polycentric Curves and Unary Gears

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Abstract: In the present paper is presented the case of the curves generated by any fixed point on line, which rolls, without slipping, over particular basic curves. In the case of rolling over polygons, and strictly necessary in the case of curved polygon, the interior contour can by used. The result is an evolvent (involute) shaped like a closed curve. Referring to this class of evolvents, the author proposed, in this paper, the term gevolvents. In the paper are presented the main types of gevolvents and some of their properties.

Keywords: evolvent, gevolvent, evolute, unary gears, simulation, Matlab.

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5. An Overview of 3D Shape Reconstruction Methods

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Abstract: 3D shape reconstruction methods are applied in exploration of a large variety of research areas, mostly in engineering, medicine, science and virtual simulations. In this paper it is presented an overview of 3D shape reconstruction methods that are used in the present engineering. These methods are considered the patented technical solutions used to collect and to obtain a 3D coordinates of a desired region of an object surface. In nowadays there are many 3D reconstruction methods developed to obtain three-dimensional information of an object reflecting surface. For engineering applications there are contact and non-contact approaches. A short description of each method of these two approaches is described in this article.

Keywords: 3D, surface, object, shape, reconstruction, acquisition, scanning.

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6. Compressed Air at Medium and High Pressure Used in Pneumatic Automations at Maximum Energy Efficiency

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Abstract: This paper highlights on the one hand, the basic requirements that must be fulfilled by the compressed air to be

used in optimal energy conditions at medium and high pressure, on the other hand, the methods for recovery of energy dissipated in these conditions, in order to improve the energy efficiency of pneumatic systems. This approach is necessary knowing that at high pressure air can dissipate the most of its energy, and because of this measures must be taken to diminish these losses or recover the energy.

Keywords: parameter optimization, pneumatic systems, mechanical systems, mechatronics, compressors.

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7. Equipment for Apllication of Fertirrigation at Horticultural Crops

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Abstract: Fertirrigation, modern concept of agricultural technique, is the method by which fertilizing substances are distributed to plants simultaneously with irrigation water. The main advantages of this method arise from the following aspects: it replaces the traditional system of administering chemical fertilizers, which implies the existence of complex machine systems, significant consumption of energy and labour, low coefficient of uniformity of distribution, removal from the crop of plants trampled by the wheels of machinery involved in this technology; it facilitates fast access of fertilizing substances to the plant root system, in convenient time, better valorification of them; studies previously carried out have found that in a classic system of fertilization in normal years in terms of rainfall plants capitalize about 65% of nutrients applied as fertilizer, while in years with drought they

can only capitalize 40%; they avoid the phenomenon of lingering of chemical fertilizers to the soil surface (implicitly, losses of active substance through evaporation), long direct contact of them with the leaf system of plants; it allows very accurate dosing of nutrient solution components, depending on the nutritional requirements of plants as determined by chemical analysis of soil; technical solution adopted to develop the equipment for injection of fertilizing substance in irrigation water, in shape of a double membrane displacement pump, ensures proportionality of the injected flow with the flow inside the irrigation installation; the driving fluid that actuates the shaft of the pump, mounted in parallel with the main circuit of the irrigation installation, is represented by water taken from the supply pipe of this pump; overpressure required for the injection of nutrient solution in the same pipe is achieved by adopting the principle of difference in surface between driving chamber and injection chamber; linking between the technical elements of irrigation and the technical elements of fertirrigation, allows that, at the end of watering, when reaching the depth of penetration of water into the area of predominant development of plant root system, to administer all of the necessary plant nutrient solution, as determined in correlation with the state of growing of the crop.

Keywords: fertirrigation, dosing pump, membranes.

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8. Considerations about the Structural and Functional Characteristics of a High-Response Proportional Valves

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Abstract: In industry there is a need to make operations more productive to keep up with competition. In the machinery that translates often through requirements for greater speed and precision moving parts. High response proportional valves, that can be used to machinery, approaches, or are even similar in some ways, with the servovalves. They can successfully replace the servovalves in applications such as closed loop, which were only possible using servovalves at a lower cost and lower maintenance requirements. The article shows the structural characteristics and performance as well as elements of mathematical modeling of these high-response valves.

Keywords: high-response valve, fluid power, positioning, flow, pressure, control.

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9. Contact Mechanics and Friction on Novel Linear-Motion Bearing with Helical Insert

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Abstract: Helical inserts provide convenient service on low-friction linear-motion bearings. However, effective design requires a better understanding of contact mechanics and

friction phenomena involved in the functioning of such bearings. The authors assume predominantly elastic contacts between the elements of the bearing, analyze the local deformations and pressure distribution and attempt to evaluate the friction forces.

Keywords: linear-motion bearings, contact mechanics, translational friction.

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MEASURING AND TESTING SYSTEMS

1. Monitoring of Epoxy Resin During the Tensile Testing

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Abstract: The optimization of already known mechanical constructions and devices has always been a challenge for the engineers. Due to the fracture toughness and strict tolerance specification during the assembly process of constructions and systems, the utilization of the new adhesive in the mechanical devices is highly recommended. A very promising category of adhesives has, as a basis, epoxy resin. The reason for choosing the investigating epoxy resins is their excellent mechanical (high fracture toughness in compacting) and chemical (toughness in solvents and at high temperatures) attributes. In the current paper, the behavior of epoxy resin DP 490 according to its thickness taking over static tensile load with the use of acoustic emission is investigated. The theoretical part consists of a simulation test investigating the behavior of the epoxy resin, with the help of ANSYS software and the calculations, having as basis FEM elements, are completed. The testing process consists of the study of the epoxy resin's behavior in rectangular cross section aluminum work pieces, following DIN 50125 pattern with the use of Acoustic Emission.

Keywords: epoxy resin, FEM simulation, tensile testing.

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2. Fault Diagnosis of Roller Bearings Using the Wavelet Transform

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Abstract: Ball bearings are perhaps the most widely used machine elements and a lot of important and expensive mechanic systems are based on them. Thus, it is necessary to establish a method to detect faults in order to keep the systems running properly. Fault identification of rolling element bearings employing condition monitoring techniques has been the subject of extensive research for the last two decades. Vibration signals of machines provide the dynamic information of the machine condition taking into account the fact that whenever the rolling element encounters a defect, a short duration impulse is generated. These signals are very useful for fault diagnosis. In this paper, the Fast Fourier Transform (FFT) is initially employed for an first comparison between healthy and defective bearings. Then, the main signal analysis is performed using the Wavelet Transform Method (WTM) which proves very effective in problems of this type.

Keywords: Bearings, Vibration, FFT, Wavelet.

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3. Periodontal Disease Apparatus Used for Measuring and Computerized Monitoring Using a Sliding Bearing with Helical Convolute Element

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Abstract: Sliding bearings are very well defined both from theoretical as well as constructive point of view mechanical assemblies, the main features being the gap between the bearing's elements, its precision and the frictional forces. In general, they control the purely linear movements. A special case occurs when the mobile / guided item is flexible and moves on a winding path. Such a situation was identified at a medical instrument used for measuring the gum's detachment from the tooth depth, which can tell the periodontal disease's evolution status. This tool should have a stylus - a flexible cylindrical rod 0.5 mm in diameter, which move over a distance of 20 mm with a constant force of 0.2 N. The medical rigorous condition requires a constant friction force whose knowledge, based mainly on experimental research, represents the present work's goal, the results being presented and analyzed.

Keywords: sliding bearing, computer monitoring, periodontal disease, controlled friction

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4. Research Regarding the Building of an Experimental Setup for the Testing of a New Type of Rotating Machine with Profiled Rotors

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Abstract: The purpose of the research is to theoretically establish the simple characteristic diagrams of the rotating machine and to verify them by experiments. In order to reach this goal, the scheme of an experimental setup was elaborated, as well as its constructive solution. The final part of the paper presents the method of the measurements to be performed.

Keywords: rotating machine, profiled rotors.

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5. Research Regarding the Construction of a Mechanism Used for the Displacement of an Oxygen Meter Probe

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Abstract: The paper justifies the need for measuring the concentration of oxygen dissolved in stationary waters; in order to perform accurate measurements, the oxygen probe

must be displaced inside water with a speed greater than 0.3m/s. The constructive solution of the driving mechanism, its functioning and the results of the performed measurements are exposed.

Keywords: stepping, microcontroller.

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6. Analysis of a Turbine Wheel Inspection Process

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Abstract: Rapid developments and improvements in advanced manufacturing technology mean that the inspection process plays an important role in the quality control of manufactured products. This paper aims to present the non contact laser scanning process of a turbine from a vehicle engine. A turbine has very complex free-form surfaces making dimensional quality control more difficult as it needs a lot of time to be accomplished. Matters about the influence of spraying, laser orientation and precision, on accurately acquiring important shape features, are discussed. It will also show information upon the accuracy of the process by comparing three different scans of the turbine.

Keywords: comparison, point cloud, scan, turbine, laser.

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7. Laser Scanning Vibrometry Applied to Non-Destructive Testing of Electro-active Polymers

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Abstract: The applications of high performance polymers in the industry and medicine in the next years need to develop new non-destructive testing methods. ES2T is a research team dedicated to the laser vibrometry and holography in cooperation between the CRITT-M2A and the LGCgE (ex LAMTI) of Université d'Artois/IUT Béthune. The laser scanning vibrometer PSV 200 used is made by Polytec Company. The object is electrically excited to induce a measurable micro deformation. The scanning laser vibrometry measurements showed up the micro deformation profiles of the objects made by high performance electro-active polymers.

Keywords: laser scanning vibrometry, electro-active polymers, non-destructive testing

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8. Comparative Study of Electromechanical Response in Some Dielectric Elastomers

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Abstract: Dielectric elastomers, a subclass of electroactive polymers (EAP) materials, are very promising for actuator and sensor applications due to their interesting properties such as high energy density, high strain levels from 10 to 380 % and fast response in order of milliseconds. Polymer films were sandwich between two rigid electrodes and subjected to high DC electric fields. We investigate the transverse strain responses of some dielectric elastomer actuators (DEA) using an eddy current displacement sensor. Electric-field-induced thickness strains in order of micrometers were measured at different high DC step voltage and a quadratic dependence was observed. A comparison has been made between three categories of elastomers. The preliminary results show that performance of the actuators not only depends on the material properties but it is also a function of the actuator structure and electrode materials. We also concluded that these materials may be candidates for actuator materials in micro-actuation mechatronic systems.

Keywords: dielectric elastomer, transverse strain response, actuator materials.

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9. Measurement and Analysis System of Geometrical Profiles with Applications at Rolling Profiles of Railway Vehicle Wheels

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Abstract: The developed system for this application , determines the wear grade of the wheels for railway vehicles by comparing the measured/scanned profile with the ideal profile that results from measurements . The system components are: high precision sensor of type laser, translation system of which course assures the displacement on the measurement axis and the acquisition and processing system with the help of a specialised software which represents also the novelty element of the system. The system permits the drawing and analysis of rolling profiles of the wheels for railway vehicles also when they are in stationary time (stations, revisions, etc.), editing the measurements bulletin according to AFER demands and the data transmission through mobile internet at a central server. The system was exposed and presented at the International Technical Fair Hanovra 2010 in National Agency of Scientific Research and also at the International Fair Bucharest 2009 in Research and Innovation pavilion

Keywords: transport safety, rolling profiles, wear parameters, rolling profile geometry, wear state, wheel rim, measured/scanned profile, q_R quota.

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10. Assessment of the Sedimentation Process in Reservoirs Using Real Time Acoustic Measurements in Fixed Points

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Abstract: Due to the silting process, the useful volume of the reservoirs continuously decreases, with severe economic implications arising from this. Knowing the dynamics of this process presents interest primarily to those who exploit the lake, but also more generally through the environmental implications. Making bathymetric maps of dam lakes is as old as the dams themselves and was done particularly by measuring the water depth in *x-y* coordinates at certain time intervals and comparing these values. The accuracy of these determinations, however, is related to the precision of the *x-y* coordinates location for the measurement points. For a more accurate assessment of the deposition process, it can be made measurements with an instrument attached to one or a few representative points which transmit real-time the measured values with a programmable sampling rate in a certain range. Description of such measurement method that rely on ultrasonic devices is covered by this paper.

Keywords: reservoirs silting, ultrasound transducer

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11. Diagnosis Techniques for Bearings Scuffing Failure

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Abstract: Bearings are often critical components of machines requiring the application of condition monitoring techniques. Several techniques to detect the condition of bearings are needed. Condition monitoring is a useful trend that indicates when deterioration will exceed the limit, and thus maintenance work can be planned accordingly. This paper presents virtual instruments that save the vibration signal captured by the sensor and analyze it in time, amplitude and frequency domains. The measured value is compared with the known limiting value. Also, data acquisition and signal conditioning and processing of the bearing friction forces created an efficient virtual instrument to estimate the scuffing failure in ball bearings.

Keywords: monitoring techniques, virtual instruments, vibration signal, bearings, scuffing

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12. A Study upon the Current Status of the Coordinate Length Measuring Devices for Distances between 10 and 2500 mm

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Abstract: Mechanical measuring devices are very important in any field of science. When it comes to production, these devices provide humans and machines the necessary information needed to preserve the products quality and standards. We are presenting a study conducted upon the state of the art measuring devices and sensor heads. Thus we are discussing four types of fixed devices and a mobile one, contact and contactless sensor heads, presenting advantages and disadvantages for each one of them,

Keywords: coordinate measuring devices, Cartesian coordinates, polar coordinates, stylus, sensor heads, flexible lines, machining and measuring centers.

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13. Autonomous System of Vibro-Acoustic Monitoring of the Grinding Process to Increase the Quality of the Processed Parts

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Abstract: This paper presents a modular self vibro-acoustic system for monitoring of the process of finishing by grinding to increase the quality of grinded parts. This system can be easily reconfigured and it can be used for other types of processing.

Keywords: vibro-acoustic monitoring, grinding, increased quality.

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14. An Optical Triangulation Method for Non-Contact Complex Surfaces Measurement

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Abstract: In this paper we present a system for 3D surfaces measurement with three inter-changeable measurement heads which can be easy mounted on its Z axis. This paper is focused on the measurement system based on 2D triangulation laser sensor. This method is highly independent from surface properties and allows significant range of measurements. The paper presents the measuring system architecture, the measuring principle and some considerations about system calibration.

Keywords: free form surface measurement, optical triangulation, laser scanner, coordinate measurement, non contact measurement.

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15. Contribution to Execution of Optomechatronic Measuring Subsystem for the Light of Night Sky Background Flux

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Abstract: Night sky light background is the main factor limiting the threshold of all types of atmospheric Cherenkov detectors. The purpose is to build a complex system to measure the light of night sky (LONS) (range 300 – 700 nm in the electromagnetic spectrum) background which affect the astrophysical observations carried on by the ground based Cherenkov telescope experiments (IACT). These telescopes are at present the most powerful instrument used in the high energy gamma ray astronomy, in the range 10 GeV to 100 TeV. A large flux of the LONS photons leads to major difficulties in the reconstruction of the direction and the energy of the primary gamma ray at the lower edge of the spectrum (< 300 GeV), as well as the irreversible degradation of the radiation detectors employed by the telescope camera. The proper evaluation of this flux is vital for the procedure to choose some observational locations for the Cherenkov telescopes.

Keywords: Cherenkov telescopes, night sky background, optomechatronic.

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16. Development of a Computerized System for Controlling Package Encasing in the Food Industry

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Abstract: The computerized system for controlling package encasing in the food industry is an integrated system of computing and control created for a total control of the encasing of the canned product. Thus, there shall be measured the encasing parameters and the dimensional and shape parameters of the packages subject to the sterilization process to find out defects that may lead in time to the alteration of the content.

Keywords: computerized system, encasing of the canned product, sterilization.

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17. On Improving the Accuracy of Length Measurement in Clinical Orthopedic

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Abstract: The paper deals with a length measuring system which is fixed to the operating table or to the patient's bed and assures intra-operative limb length measurement with high accuracy and ease of use, and whose probe can be sterilized.

Keywords: limb length, intra-operative measurement,

measuring system, incremental transducer.

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18. Fuzzy Logic Used in FMEA Analysis

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Abstract: Prioritization of risks associated with failure modes is performed usually by computing risk priority numbers (RPN). A traditional RPN is obtained as product of three indexes: occurrence, severity and detection. Fuzzy RPNs are considered a promising solution in order to give a more accurate ranking of potential risks.

Keywords: quality assurance, failure modes and effect analysis, fuzzy risk priority numbers.

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19. Virtual Instrumentation Software Used in Electrical Arc Monitoring

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Abstract: The mass transfer and the electric arc monitoring during arc welding processes are the most important

phenomena. The authors propose a modern investigation technique, using high-speed video monitoring performed with High-Dynamic-Range-CMOS camera (HDRC), with external trigger, synchronous with the electrical arc parameters measurements. The paper focuses on the development of dedicated software for electrical arc monitoring. The authors choose to develop these instruments using LABVIEW virtual instrumentation and IMAQ Vision software.

Keywords: LABVIEW, IMAQ Vision, arc welding, high dynamic speed camera, artificial vision

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20. Considerations Regarding the Analysis of Plane Angle and Solid Angle, after Four Decades of Scientific Debate

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Abstract: The paper presents the main units of measurement used in the exact sciences as well as presenting new unit solid angle. Admission SI supplementary units' radian and steradian system that raises an acute problem in discussing their application in various technical and scientific fields, including a number of issues that arise.

Keywords: angular measurement units, radian, steradian.

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21. Detection of Bio-chemical Reactions through Micro Structural Interactions

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Abstract: This paper presents a highly accurate and repeatable method to detect micro-level bio-chemical reactions using the interaction between microstructure and the reactant mixed with the chemical marker. The method produces a recognizable deflection signature of the cantilever beam. Such deflections could be very large such that they exceed the linear deflection range. For determination of the large deflections of the tip of cantilever beams, an exact method is proposed. This method is using symmetry groups for finding the closed-form solution which could be applied for any boundary condition case. The open literature provides solution only for two particular loading cases: point force and point moment.

Keywords: Bio-chemical reaction, micro-structure-molecule interaction, micro-cantilever beam, deflection signature.

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22. Considerations Regarding of Mechatronics Systems for Positioning in Non-Destructive Testing

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Abstract: Quality control of welded joints and the structure of materials is made with techniques becoming more efficient. It

is having site of the compliance and obtaining of special metrological characteristics of means of control as: accuracy of results, operability of their obtaining and interpreting, viability and conservation of the control results, the accuracy of results and their correlation with reality controlled. A commonly used class of techniques is known as non-destructive testing (NDT). Among the known NDT variant tipes in this work are taken under study those based on the principles of radiation emission (X-rays) and ultrasound. Obtaining reliable results, approached in a short time and protected from the effects of disturbance factors depends on different parameters of control techniques. Among these should be mentioned: the correct positioning of the emitter of radiation and the waves , against the weld and / or parts-piece surface, the position control of these parts, so that to be respected the terms of "feeling" and "collision" of the weld and surface, the conditions imposed by the NDT equipment manufacturing company, replacing attributions of human operators in NDT in order to protect them against irradiation etc. In this paper are detailed factual information about these issues. It is insisting on mobile systems designed in view of mechatronics, introduced in the NDT structures.

Keywords: NDT structures, NDT equipment

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23. An Analysis of a Roller Coaster Braking System

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Abstract: Roller coasters are the safest rides that can be found in amusement parks. As train, a roller coaster needs a safe brake system which can stop precisely at the end of the ride or in an emergency case. In this paper are analyzed the types of brakes met at roller coasters. The focus will be on the

magnetic brakes. The purpose of this paper is to analyze the magnetic braking system relying on theoretical and practical aspects, on formulas and experiments regarding the most convenient braking system.

Keywords: roller coaster, braking system, magnetic brakes.

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24. Extrinsic Camera Calibration and Camera-Matching for Plant Phenotyping Using CAD (Computer-Aided Design) Models

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Abstract: Automatically intra-row weed control is the focus of many researches. In the future, we propose to develop an autonomous mobile robot for mechanical weed control, which must be able to follow rows, recognize plants and remove weeds. Weeds and crops can be distinguished due to several attributes like color, shape and context features (Oberndorfer, 2006). For plant phenotyping, we proposed to use multi-camera networks consisting of 3D-ToF (Time-of-Flight) cameras and 2D-color cameras. Camera calibration is the first step towards computational computer vision (Salvi et al., 2000). This paper presents an extrinsic camera calibration method using CAD (Computer-Aided Design) models.

Keywords: camera calibration, agricultural robot, weed control, multi-sensor fusion, computer vision.

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25. A Critical Analysis Regarding the Roller Coasters' Mechanisms

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Abstract: The paper presents the main mechanisms used to drive the equipments from amusement parks, especially rollercoasters. According to their structure, there are three types of rollercoasters: with a steel structure, a wood structure or a hybrid between them, being also realized a critical analysis regarding this types. Based on the structure of a traditional rollercoaster it is made a functional analysis of conventional roller coaster installation. There are also taken into account the mechanical considerations regarding the installation's functioning. The vehicle is pulled by a chain called "rack" until it gets to the highest point of the equipment while the vehicle gains potential energy which converts to kinetic energy during the descending. On this basis there are also analysed the centrifugal force, the breaking strength of the chain lift, the inclination in the longitudinal and transverse plan and the rescue system (situated at every ascending part of the track).

Keywords: roller coaster, mini-vehicle, steel tracks, rescue system.

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26. Surface Description and Measure of Spur Gear Flanks

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Abstract: Gears are the most common used machine parts, which transmit rotary motion between two shafts. Determining the profile errors means improving the gears. This paper presents the state of art of the profile control machines and methodologies. Otherwise, includes measurements which were made with a coordinate measuring machine. Measuring the tooth's surfaces, coordinates were obtained, which were compared with the theoretical data. This comparison results the profile errors which were determined within Matlab software. A statistical distribution was made.

Keywords: quality inspection, measurement, spur gear, involute curve, profile error.

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27. The Kinematics Solution of Biped Robots

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Abstract: This paper deals with the kinematics solution of biped robots. It debates the direct and inverse kinematics problems of Leg's 3-dof biped robot, with which a leg can accumulate a position by multiple angle combinations. A possible solution will be presented, which helps to solve the stability problem.

Keywords: mechatronics, direct kinematics, inverse

kinematics, robot biped, stability

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28. Virtual Prototyping of a Car System Used for Impact Simulations

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Abstract: This paper presents issues concerning the use of CAD systems in modern technology virtual prototyping, in this case a complex virtual model for a car system used for impact simulations. Virtual prototyping is a process that uses a virtual prototype instead of the physical prototype for testing and evaluating specific elements of the designed product. Virtual prototype is created on the computer closer to the actual characteristics and operating conditions so as to allow the simulation to perform the role for which it was designed. The three-dimensional model has been exported into simulation software able to perform kinematics simulations and finite element analysis, at the same time. With that virtual model were analysed different situations similar with car crash. Results of simulations have been analysed and compared with measurements made on the real models.

Keywords: virtual prototyping, car system, crash simulation, testing.

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29. Structural Improvement of Feeding and Dosing Systems Used in Automated Dimensional Inspection

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Abstract: The main purpose of this research is to generate optimised feeding, transport, and proportioning and alignment systems for more mechanical efficiency of automation system. The basic idea underlying this research is to organize a complex system as a set of distinct components that can be independently developed and then plugged together to obtain an integrated mechatronic system for dimensional inspection.

Keywords: quality inspection, control, feeding system, dosing system, control

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OPTICAL AND OPTOELECTRONIC SYSTEMS

1. 3D Imaging Of Indoor Environments with Mobile Photo-Camera

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Abstract: This paper presents an algorithm for full 3D imaging of indoor environments with mobile shooting camera. Data is acquired by slow-moving photo-camera equipped with two 2D laser range finders. Present approach combines an efficient scan matching routine for camera pose estimation with an algorithm for approximating environments using flat surfaces.

Keywords: 3D models, virtual reality.

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2. Electronic Spectroscopy for Industrial Use Modular Device and Engineering Software

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Abstract: Spectral characterization and testing is common with many laboratories in many fields but most of them in biology, chemistry or physics, where the test are solid samples or solutions in tanks or on blades. Many laboratories use optical general purpose spectrophotometers and adapt method of testing to specific product. It only allows the characterization of spectral evidence in the form of strips parallel plane approached in a gear assembly or an assembly using reflection spectrum of a sample reflecting plane at an angle near 45^0. In recent years, manufacturing miniature spectral analyzers has led to many types of spectral analysis equipment. It also benefited the spectral characterization of optical components. Made known systems are designed: test plan components parallel blade type; reflective testing of protective coatings. The outcomes of the project carried out in the contract nr.143/2008/ANCS**,** is to achieve integrated technologies and equipment**,** multifunctional**,** which can be used to characterize the spectral flow on both miniature optical systems and classical**.** SPECTECH equipment developed in this project is a prototype was built to satisfy these basic functional requirements

Keywords: Optical spectroscopy, software engineering.

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3. Color Vision Tests. Method and Device

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Abstract: Authors describe a practical method applicable to all subjective tests that makes use of a novel technique to analyze all influence factors, namely eyes ametropies. Using a hue Farnsworth panel, as an example, we specify how to determine lack of image fusion and demonstrate the benefits of testing color and common vision at a whole. The first thing that create a color impair is the confusion angle which identifies the *type* of color defect; the second is the Confusion index (C-index) which quantifies the *degree* of color loss relative to a perfect arrangement; and the third is the Selectivity index (S-index) which quantifies the amount of *polarity* or lack of randomness in a color arrangement. Analyzing color matching in stereo vision can induce a global result and give an answer about individual capacity to react and identify a multiple warning signals.

Keywords: color test, hue test, discromatopsy.

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4. Object Recognition Using a Smart Camera

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Abstract: This paper presents a general approach regarding computer vision and object recognition importance. The most utilized methods and the most common application which involves object recognition are also described. In this context an application it is created for identifying a few types of objects using Vision Builder for Automated Inspection software and a smart camera. The used method can be implemented in a further research for automated assembly operations with industrial robots.

Keywords: computer vision, object recognition, image processing, smart camera, objects identification.

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5. Refractive Index Discontinuities in Fiber Optic Connectors

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Abstract: Connector loss variability has an important impact on planning and developing fiber optics networks. Interdisciplinary design considering optical and contact mechanics phenomena at the interface between connected waveguides with physical contact is a key element in

providing sound recommendations for technology. The authors focus on studying the influence of refractive index discontinuities occurring on fiber optic connectors with physical contact and suggest design and manufacturing approaches for controlling it.

Keywords: fiber optic connectors, hertzian contact, wave coupling loss, interdisciplinary design.

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6. Study of a Robot-Vision Solution for Tracking Objects

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Abstract: This paper presents the study of a possible robot-vision solution for tracking of a 6-DOF (3 translations and 3 rotations) moving object using only one video camera. This method uses three markers to identify the object and requires that the distance between the three markers and initial position to be known. The mathematical algorithm is presented together with the geometry on which it is based. The MATLAB's Equation Solver is used to solve the equations from the mathematical model. A practical Simulink implementation is given. The solution is tested on a real-life system, using a webcam and 3 color markers, and on a virtual video on which the trajectory of the object is known and can be compared with the results. Experimental results are presented.

Keywords: robot, computer vision, tracking

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7. UV Light Curing Adhesive for Optical Assembly Application

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Abstract: UV light-curable adhesives cure in seconds upon exposure to long wave ultraviolet light and/or visible light, heat, or with an activator. Light-curable adhesives optimize the speed of automated assembly, enable 100% in-line inspection, and increase product throughput. Industrial adhesives are available for glass assembly, plastic sealing, metal bonding, and as well as for joining dissimilar substrates.

Keywords: UV curing, UV photo-polymerization.

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8. Real-Time Image Processing Algorithms for Object and Distances Identification in Mobile Robot Trajectory Planning

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Abstract: In this paper we present a suite of algorithms for determining the possible trajectories of an autonomous robot while navigating through obstacles. For this, we first identify the obstacle orientation and then determine the distance between

each two obstacles and compare it with the robot width. The results of these algorithms are intended to be used by the robot path planning, for selecting the best trajectory. The algorithms are relatively simple and accurate and can work successfully even on robots with medium computational resources.

Keywords: autonomous robot, robot vision, image processing algorithms, Canny edge detection, K-Means clustering.

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9. Mode Transforming Properties of Taper Microlensed Fibers

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Abstract: Drowned tapered and microlensed single-mode fibers offer significant manufacturing advantages as waveguide couplers. However, controlled manufacturing requires a better understanding of beam propagation in such photonics devices. The authors investigate the mode transforming properties of drowned tapered and microlensed fiber optics and suggest optimal geometries.

Keywords: waveguide coupling, tapered and microlensed single-mode fibers.

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MANUFACTURING EQUIPMENT, METHODS AND TECHNIQUES

1. Micromachining of 2D-3D Structures with High Intensity Laser Pulses

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Abstract: Nowadays MEMS, fluidic devices, advanced sensors, biomedical devices and instruments etc. are important applications for strategic sectors. These are demanding suitable tools for materials processing, especially for developing tasks in different kind of materials and geometries around the micron, since this dimensional range emerged at the crossroad of nanotechnologies and conventional fabrication techniques. Specific laser based machines for each process of interest (initially working only in 2D) were rapidly developed, and an important gap has been generated, from the fabrication point of view, in targeting fully 3D applications. This paper briefly describes the design and notable applications of a multi-axis laser micromachining workstation based on the main concept of flexibility, that was developed at the UPM Laser Centre of the Polytechnical University of Madrid (Universidad Politécnica de Madrid). This system integrates an advanced 6-axis positioning system and two UV laser sources, excimer and DPSS working in nanoseconds pulse regime, for precision 3D micro-machining of complex parts. A short description of the most relevant features of this micro-manufacturing cell is provided. Advanced materials (including composites) were machined at a dimensional range of microns for the processed zones. The main issues overcame by the authors in generation of 2D/3D structures by high intensity laser pulses with direct incidence are briefly described. Several examples of the applications achieved with this system, including processing of advanced sensors, organic materials for biomedical devices and metallic materials

for important industrial sectors are presented.

Keywords: manufacturing systems, multiprocessing systems, equipment, mechanisms, sensors, medical applications, MEMS, laser micromachining, advanced materials.

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2. Recent Achievements and Trends in Laser Welding of Thin Plates

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Abstract: Laser Welding (LW) is more and more chosen as manufacturing process due to its advantages, namely capability of joining small dimension parts, opportunities for joining of special materials, less Heat Affected Zone, good repeatability, high speed etc. Nowadays, LW is of particular interest in manufacturing small mechatronics parts of mechanic, electric or electronic nature. This paper underscores several achievements in three key-processes, namely classical LW, laser hybrid welding (LHW) and remote laser welding (RLW). These results were obtained at the UPM Laser Centre (CLUPM) of Polytechnical University of Madrid (Universidad Politécnica de Madrid) with a CO_2 laser of 3350 W dedicated to RLW of thin sheets for automotive and other sectors, and with a Nd:YAG laser of 3300 W, respectively. The second is operated by a 6-axis ABB robot and is meant for various laser processing methods, including welding. Several important applications experimented at CLUPM and recently implemented in industry are briefly presented: RLW of coated sheets (with Zn or Al), LW of thin sheets of stainless steel and carbon steel (dissimilar joints), LW

of high strength automotive sheets, LW vs. laser hybrid welding of Double Phase steel thin sheets, LW of Shape Memory Alloys (NiTi). The way in which the team of CLUPM has addressed some knowledge gaps related to LW, LHW and RLW are underscored, together with the benefits of the new technologies for both science and industry.

Keywords: automobile industry, manufacturing systems, equipment, laser welding, coated steel sheets, shape memory alloys, dissimilar joints.

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3. Applications of LIGA Technology for the Development of Micromechanical Systems

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Abstract: In this paper**,** it is presented the fabrication technology of mechanical structures using LIGA technology. In the manufacturing process there have been processed miniature gears with outside diameter of 0.9 mm, electroplated from Ni on a silicon wafer coated with 100 µm thick SU8 photoresist. All process parameters for the exposure , developing, electroforming and removal exposed SU8 were optimized. Dimensional measurements were made for the finished parts, comparing them with design data. This research implies that various types of MEMS devices can be developed at a low-cost with design flexibility.

Keywords: microfabricaton technologies, micromashining, direct writing lithography, UV-LIGA, SU8.

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4. Robotized Laser System for 2D-6D Cutting of Stainless Steels

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Abstract: The paper presents some problems regarding profile cutting 2D-6D using robotized laser systems of stainless steels, the factors that influence these processes and some results of experimental researches.

Keywords: laser robots, cutting, stainless steels.

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5. The Material's Temperature Influence on Absorption Degree of Laser Radiation in Technological Processes

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Abstract: This paper presents a study stage regarding the

influence of certain factors on absorptivity of laser radiation in the manufacturing processes. The current study, presented in this paper, proposes a small device that alters the optical properties of the material by heating leading to a good energetic coupling between the laser beam and material.

Keywords: laser manufacturing, laser absorption, optical properties, laser processing.

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