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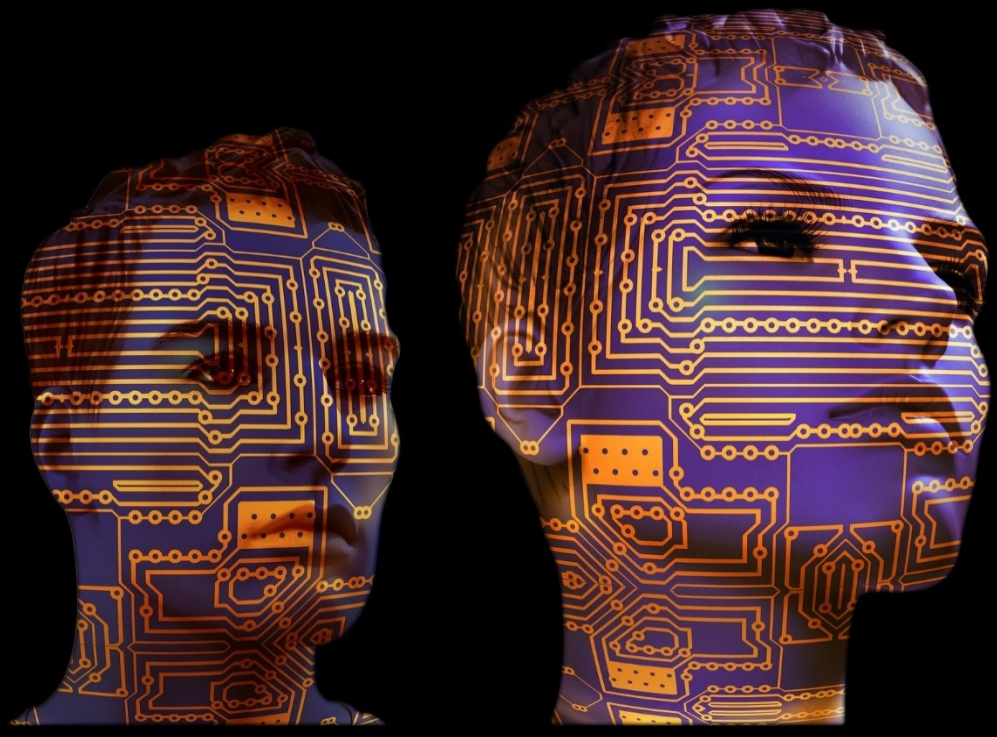

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Study of a Test Stand for Determining the Oil Density in Hydraulic Systems

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Abstract. The purpose of this paper is to document the development of a test stand that enables experimentally determining the viscosity of the fluid used in a hydraulic system. This test stand also doubles as a method for determining the influence of the temperature and pressure on this parameter. The resulting setup allows full control of the system while also measuring and processing the measured data. For the core of this type of system a microcontroller was selected. High performance transducers are used for ensuring accurate measurements, they provide a proportional electrical output. The microcontroller firmware mostly runs as a command processor, a LabView program is responsible for communicating with it in order to acquire data and control the system variables in a predefined sequence.
Keywords: hydraulic oil, density, hydraulic drive system, the theoretical and experimental analysis.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_1

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The Absorbents Nanoporous Structures Regeneration for Industrial Dryers by Microwave Energy

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Abstract. The presented work is devoted to solving the problem of energy conservation in industrial production. Modern industrial equipment and technological processes use compressed air energy. Wherein deep drying of compressed air is often required. The air preparation process is an expensive and energy-intensive process. Reducing useless energy losses, in this case, is possible through the use of innovative technologies that are technically feasible and economically justified. The adsorption air dryer's efficiency feasibly increased by using microwave energy to regenerate the adsorbent by deporising water molecules from its nanoporous structure. This paper explores the application of this regeneration technology in air dryers which have high throughput. The scientific novelty of this submitted research lies in this study of the regularities of the spatial distribution of thermal and electromagnetic energy and their uniform distribution in the adsorbent volume if the pro-posed innovative technology is applying. Also, it was establishing the dependence of the intensity of exposure to microwave energy depending on the frequency, voltage level, and design features of the adsorption tower. The practical significance lies in the proposition of a new technological process for the regeneration of the adsorbent in adsorption dryers with high performance.

Keywords: Nanopores, Air Dryer, Regeneration, Microwave Energy.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_2

Lifetime of Optical Fibers Submitted to Thermo-Mechanical Stresses

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Abstract. The reliability and the expected lifetime of optical fibers used in telecommunication technologies are closely related to the thermo-mechanical and chemical environment actions on silica network. To ensure the long-term mechanical strength of the optical fibers, a polymer coating is applied onto fibre surface during fiber fabrication. The coating protective action includes several functions, such as: to protect glass fiber from any external damage, to limit chemical attack, in particular those of water and temperature.
This paper presents the results of new silica optical fibers aged in hot water between 20°C and 70°C and subjected to mechanical static bending stresses from 2.5 GPa to 3.2 GPa. The mechanical strength of optical fibers aged in distilled water at different temperatures was studied. Optical fibers were then wound around ceramic mandrels with different diameters in order to evaluate the influence of the static bending stresses on the lifetime of the fiber. Dependence of the time to failure on temperature was observed and different fatigue parameters such as activation energy, fiber lifetime and stress corrosion parameter can be analyzed and a behavior law can be pro-posed.

Keywords: Optical Fibers, Thermo-Mechanical Stresses, Lifetime, Bending Tests, Stress Corrosion Parameter.
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Design of a Mobile Robot to Work in Hospitals and Trajectory Planning Using Proposed Neural Networks Predictors

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Abstract. Considering the intense and tiring working conditions in hospitals, healthcare personnel's performance decreases during prolonged working times, and patients are directly affected by this decrease in performance. This study aims to design and implement a mobile robot that can help healthcare professionals improve the healthcare industry conditions. In this context, the focus is on the mobile robot performing two main tasks. The first task is dispensing medication to patients with an eight-chamber mechanical feeding unit. Thus, patients can take only their medicines from the defined reservoir by selecting their names or photos on the touch screen. The second task is to interact with patients to give moral support with phrases such as "good morning", "you look great today". Also, drug delivery activity is

recorded in a database, and the health status of the patients can be kept under surveillance with the camera on the mobile robot. The designed mobile robot goes to the patient rooms with magnetic strip tracking. For this purpose, a controller is designed for the omni-drive robot using MATLAB, and its performance is simulated. Also, the control velocities that enable tracking the trajectories are taught to artificial neural networks (ANN), and the requirement magnetic strip for trajectory tracking is eliminated. In this direction, two artificial neural networks are compared in terms of their learning performance.

Keywords: Mobile Hospital Robot, Omni-Drive, Controller Design, Trajectory Tracking, Neural Networks.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_4

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Design and Measurement of the Peltier Cell Thermal Actuator for Fine Adjustment

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Abstract. The article presents design and experimental validation of a thermal actuator based on peltier cell control. The experiments showed the possibility of fine adjustment of large-scale objects in the working range of 24 micrometers with a sub-micrometer resolution capability. We have proved the main body of the actuator is not affected with heat effects during the actuator control.

Keywords: Thermal actuator, Peltier cell, Fine adjustment.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_5

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S-Shape Feedrate Scheduling Method with Smoothly-Limited Jerk in Cyber-Physical Systems

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Abstract. For the successful implementation of innovative automated technological processes, such as high speed machining, 3D laser welding, 3D laser cutting and laser cladding it is necessary to provide highly effective control of the working tool movement speed in multi-axis space of cyber-physical system. A simplified three-interval model S-shaped feedrate profile with smoothly-limited jerk using the sin2 function are proposed. An algorithm for pre-scheduling of the feederate before the start of motion control, which has no constraints on the number of analyzed blocks and the scheduling execution time is proposed. Modeling the scheduling process on the example of a test trajectory has shown the high efficiency of the proposed model. Reduction of the processing time of the control section of the trajectory by 7.4% to 10.7% in comparison with the Heidenhain iTNC530 system with the same acceleration and jerk limitations are obtained.

Keywords: CNC, S-shaped feedrate profile, Smoothly-limited jerk, Snap
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_6

Selecting the Method for Pre-Tightening Threaded Connections of Heavy Engineering Objects

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Abstract. The choice and application pre-tightening method of the threaded connection for each specific technical object is determined both by the specifics of production and by established traditions that have passed many years of experience in operational tests. At the same time, there is no formalized scientific justification for the decision on the choice of the tightening method for the threaded connection.
In this work, based on the results of a review of the known methods of pre-tightening of threaded connections, the choice of tightening the impeller with the shaft of axial hydraulic turbines is justified. An assessment of the probability of failure-free operation of threaded connections is proposed, taking into account the applied tightening method and its weakening during operation.
As a result of the research, it was found that for the known methods of implementing and controlling the tightening of threaded connections, namely with a torque wrench, according to the rotation angle, according to the de-formation of the elastic washer, according to the elongation of the bolt, 20 percent weakening corresponds to the probability of failure-free operation equal to 0.5. The method of tightening with a torque wrench has the softest effect on the probability of failure-free operation according to the criterion of relaxation of tightening forces. The elongation measurement tightening method up to 15% loosening guarantees high reliable operation of the threaded connection with a failure rate of 0.99.
The results obtained will make it possible to scientifically select a method for the implementation and control of tightening of threaded connections of heavy engineering objects, depending on their purpose and design features.

Keywords: Threaded Connection, Pre-tightening, Uptime Probability, Tightening Weakening, Methods of Implementation and Control of Tightening.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_7

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Production Scheduling of Semiconductor Wafer Fabrication Facilities using Real-time Combinatorial Dispatching Rule

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Abstract. Fabrication of semiconductor wafers is a complicated and challenging process with huge system complexity and stochasticity in operations. To improve the above challenges and to enhance the system's efficiency an effective scheduling technique is indispensable. In recent times Real-time scheduling with dynamic dispatching rules has been widely discussed. How-ever, choosing the appropriate combination of dispatching rules in a dynamic environment is a challenge. In this study, we proposed a multi-objective non-dominated sorting genetic algorithm (MO-NSGA-II) approach for optimizing the dispatching rules by considering the multiple objectives as minimization of work in process, minimization of delay time, and minimization of makespan. To implement the proposed approach, the optimal parameters for the multi-objective evolutionary algorithm (MOEA) are selected based on the hierarchical combination method and by deploying the response surface methodology (RSM) the best combination of rules is generated. Further, a re-al-time simulated environment is created using Flexsim to check the significance of the proposed approach and the robustness of the generated combinatorial rules. Results stated that the proposed approach can improve the performance of a system to a greater extent.
Keywords: Wafer fabrication, Response surface methodology, combinatorial dispatching rules, multi-objective evolutionary algorithm, discrete event simulation.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_8

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Microindentation Hardness Testing of D–gun Sprayed Coatings

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Abstract. The prospects of application for the method of non-destructive testing by continuous indentation of an indenter for determination of the mechanical properties for thermal sprayed coatings are considered. Research to assess the microhardness of composite coatings based on the tungsten and chromium carbides obtained by the D – gun spraying have been carried out. The penetration diagrams of coatings made of powders WC – 8% Co (VK8), WC – 15% Co (VK15), WC – 18% Co (VK18S), 3%Cr – 2%C – 15% Ni (KHN15S) are considered. It is shown that under optimal spraying conditions, the microhardness of obtaining coatings is close to the microhardness of sintered hard alloys of the same composition. The values of variation coefficients of microhardness values with an increase of the indentation depth for specimens from sintered hard alloy and sprayed coatings were deter-mined. Under optimal spraying conditions the maximum values of micro-hardness and more homogeneous structure and mechanical properties of coatings are achieved.
Keywords: Indenter, Indentation depth, Variation coefficient, Microhard-ness, Spraying modes, Phase composition.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_9

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Application of Magnetic Field on Lubricating Cooling Technological Condition in Metal Cutting Process

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Abstract. In this paper, the implementation of static magnetic field on lubri-cation cooling technological condition in the machining process is discussed. Moreover, the new construction of UMD-1 and SMD-2 magnetizing devices is given in the article. Nowadays, increasing the wear resistance of cutting tools used in metal cutting processes is one of the controversial issues of the manufacturing industry. Using the effect of magnetic field on lubricating cooling technological condition can be a modern solution to this problem. For this purpose, the authors designed a new device for magnetizing flowing lubrication cooling liquids in the machining process. Technical specifications of UMD-1 and SMD-2 magnetizing devices are also given in the paper.

Keywords: Cutting process, Magnetic field, Magnetized cutting fluid.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_10

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Rapid Prototyping of a Lower-Body Exoskeleton for Paraplegia Patients

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Abstract. Since the early 2000s, powered exoskeletons have been used in military and industrial environments to increase the strength, stability, and overall safety of the user. Due to fast and notable improvements shown in the field of robotics and medicine in recent years, various medical exoskele-tons have been developed, to aid paraplegia patients, regain a certain degree of their lower body's motor function. However, many of the models availa-ble on the market currently still present certain limitations and design issues, mainly due to the complexity of the human body's construction and the user size variations.
This paper aims to design a medical exoskeleton variant to solve some of the limitations and design issues still present in medical exoskeletons sold on the market today, and to optimize the price to quality ratio to the maximum degree possible, making this device a viable option even for people from disadvantaged countries.

Keywords: Exoskeleton, Prototyping, Medical, Paraplegia.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_11

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Methods for Testing the Strength of Layers for Different Optical Coatings

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Abstract. The first part of the paper presents the test techniques and the equipment used to make them, as well as the morphological characteristics of the tested parts and the properties of the materials that compose them. Also, there are presented briefly the results obtained after testing the resistance of several types of optical coatings are presented. The full description of the testing operations and acquiring experimental results will be described in a future paper. The authors used techniques found in the literature, but also standardized ones, comparing the mechanical behavior of frequently used materials (for example: MgF2, TiO2, Ta2O5 and SiO2), deposited on a glass substrate (BK7). The tested parts are flat surfaces, with a diameter of 25 mm, covered with anti-reflective layers for the visible range. In this paper, various methods for testing the strength of thin films for three types of optical coatings have been studied and developed. The three types of coatings tested had the following morphological characteristics: AR (anti-reflective) single layer, AR 4 layers and AR 6 layers. From the results obtained from the tests, it was concluded that the strength of the optical coatings differs depending on the test to which the sample is subjected. The most resistant types of optical abrasion coatings were single-layer coating and four-layer coating, followed by 6-layer coating.

Keywords: Optical Coatings, Anti-glare Coatings, Layers Strength.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_12

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Force Simulation of Bird Strike Issues of Aircraft Turbojet Engine Fan Blades

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Abstract. The paper investigates the problem of simulation modeling of bird strike on the fan blades of an aircraft turbojet engine under operating conditions. Bird strike on the fan blades fan is modeled by an equivalent system of static forces and with an experimentally substantiated localization of im-pact points. The magnitude of these forces is determined with account for bird mass, size and speed. Such an approach, without conducting computation-intensive modeling of blade distortion and failure by using explicit dynamic analysis methods, allows assessing the stress-strained state of fan blades with much more accurate mathematical finite-element models with an admissible error level. The problem solution algorithm comprises the building of physical, mathematical and computational models with consideration for the design, mechanical characteristics of materials, operating conditions, as well as for the accepted assumptions and simplifications. The simulation modeling of fan blades yielded strains and stresses corresponding to several bird strike variants. The model was verified using several error estimate criteria, and the results were validated by comparison with bench test data. The approach suggested produces

mathematical finite-element models with an admissible level of mesh discretization error and a least possible number of finite elements. Similar models can be reasonably used subsequently in analyzing the nonlinear dynamics of interaction of a flying bird with a rotating wheel impeller, whereas the results of quasistatic analyses can be used to verify models for explicit analysis methods.

Keywords: Gas turbine engine, Fan blades, Bird strike, Mathematical simulation, Equivalent forces.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_13

ROBO-PVAFM Proper Software Platform

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Abstract. In this paper is shown one proper assisted platform made under the LabVIEW kernel, version 14.0, for analyze of positions, velocities, accelerations, forces and moments in Robotics. The platform provides assisted research for the following robots types: Arm, Scale, Cartesian, Gun and Double Portal. In order to take over in the research the aspects related to the pseudo-trapezoidal velocity characteristics, a sub*VI*-s was used to generate these characteristics taking into account the constraints for Jerk up to 6*maximum acceleration and the time parameters of acceleration, deceleration or constant walking. For the first time one assisted platform give to the researchers the possibilities to change some parameters of velocity characteristics, the position of the joints, the bodies dimensions, the bodies materials, the character of the movement successive or simultaneously and to see how these influence the dynamic behavior. The assisted platform contents some LabVIEW sub*VI*-s for the 3 × 3 transfer matrix between the Cartesian systems, the column matrix for the dual velocity relative and absolute vectors, dual column matrix for the absolute acceleration vectors, the special dual matrix form for the relative angular and linear acceleration with separately the centrifuge and Coriolis accelerations. The platform solve the Forward Kinematics (FK) and Inverse Dynamics (ID) of robots. In the future will be included the Invers Kinematics (IK) and Forward Dynamics (FD) to have one complete analyze in Robotics..

Keywords: Forward kinematics, Inverse dynamics, Assisted research.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_14

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Hardening, High-Speed Steel R6M5, Using a Combined Heat Treatment Technology

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Abstract. This article provides an increase in the reliability of drills while reducing the processing cycles of high-speed steel tools, namely cycles 3,4,5 (Fig. 1) by creating a combined processing technology that allows these cycles to be created in one cycle.

Keywords: Drill, General process, Cycle, Thermal, Operation, Tool, Fabrication, Reliability, Carbide dissolution, Tempering, Temperature, Durability, Wear-resistant, Combined, Deposit coating, Microstructure, Hardness, Salt bath, Viscosity
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_15

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Increasing the Abrasive Wear Resistance of Steels by Heat Treatment with Preliminary Preparation of the Structure

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Abstract. The abrasive wear resistance of samples made of steels St3Gsl, 35, 45, 65G, U8 is investigated. Samples of technical iron are used as a reference material. To increase the abrasive wear resistance of carbon and low-alloy steels, it is proposed to carry out preliminary normalization with an extreme heating temperature of 1100 °C before the final heat treatment. After re-hardening and low tempering, the wear resistance can increase from 20 to 50%.

Keywords: Abrasive wear, Heat treatment, Wear resistance.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_16

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Biodegradable Starch-based Polyvinyl Alcohol Films with Zinc-oxide Particles for Wound Dressing Applications

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Abstract. Starch-based composites as wound dressings feature biodegradability, antibacterial activity, and healing properties around wound areas. Available wound dressings have some significant drawbacks, such as water vapor transmission rate (WVTR) and low absorption of wound exudates. In this work, starch-based polyvinyl alcohol (PVA) blend with embedded zinc oxide (ZnO) particles (<5µm) was prepared and modified using citric acid (CA), which provides an antibacterial environment, for wound dressing applications. The prepared film characteristics were evaluated by UV-Vis spectrometry, and the results demonstrated interactions between the zinc oxide (ZnO) particles and the starch/PVA blends. Besides, the water vapor trans-mission rate of the film was measured, and results illustrated an optimal moisture environment needed for the ideal wound healing process, which al-so promotes applying this film as a wound dressing. The developed materials were demonstrated to have proper physical properties such as solubility, gel fraction, swelling index, biodegradability, and mechanical strength. Further-more, the pH level of the created material was measured to ensure the anti-bacterial properties of this material as a wound dressing application.

Keywords: Starch-based Films, Polyvinyl Alcohol, Zinc-Oxide, Wound Dressings.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_17

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Compliant Positioning System with 6 DOF for High Precision Medical Standing Applications

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Abstract. This paper wishes to present a compliant platform solution with multiple degrees of freedom, with the role of compensating vibrations and parasitic movements. In addition, there are key issues regarding the aspects of tremor, especially in the medical field. Of course, the emphasis is on the impact that tremor (vibrations) has in microsurgery, where very high positioning accuracies are required. Of interest, regarding the construction of the proposed platform, are the compliant elements that bring a series of advantages, starting from the simplification of the entire system and up to the manufacturing process of the platform, which is made monolithically by selective laser sintering (SLS) from PA2200 polyamide powder.

Keywords: Stewart platform, Compliant, Vibrations, Medical, SLS

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Formation Structure of Cement Systems under the Influence of Chemical Additives

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Abstract. In this article, the influence of polyquaternary salts on the formation of structural and mechanical properties, density and strength of hardening cement, subjected to heat and moisture treatment are showed. It was found that the maximum growth effect immediately after steaming can be obtained with the combined effect of temperature and additives.

Keywords: Hydrophobizing, Closed pores, Dispersing.

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Increasing the Accuracy of Calibration Device for Measuring the Moisture of Bulk Materials

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Abstract. The purpose of the work is to build a mathematical model of the calibration curve, which improves the measurement accuracy of the device. For improving the accuracy of the measuring device, it is necessary to carry out calibration, which consists of establishing a correlation between the readings of the measuring device and the moisture content of a particular material before measuring. To construct the calibration dependence of the developed measuring device, 15 samples of bulk materials (grain) with a moisture con-tent of 5% to 19% were taken as a measured sample, at different intervals. To determine the moisture content of the grain, measurements of the dependence of the frequency on the moisture

content of the sample were carried out. For each sample, several values of the frequencies of the measuring generator were obtained, entered into the table at the calibration frequency at .

Keywords: Calibration, Measuring Device, Moisture.
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Device for Processing Micro-Bores by Electrical Discharge Machining

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Abstract. In recent years, there has been a growing trend to miniaturization parts. As a result, the processing technology must be partially evolved to produce a small surface, and then a microscopic surface. There are many of these technologies, and each has its advantages and disadvantages in the industry. Among these technologies, electric shock processing is used as an alternative with the required precision. Processing of very small wells by the method of electric emission is similar to that used in the processing of nor-mal-sized machines and will be noted on paper. In this research, the authors developed a device for drilling holes 0.01-1 mm in diameter that can be in-stalled in traditional non-electric machines.

Keywords: Micro-EDM, Micromachining, Micro-holes.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_21

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Communication and Control Algorithms for a Heterogenous Multi-Agent System

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Abstract. The SICOLET project is centered around a collaborative multi-agent system consisting of an ekranoplan, an unmanned aerial drone and a ground- based vehicle which is equipped with a mechanical manipulation device. All the agents are capable of a semi-autonomous operation, meaning, they can all be controlled manually via analog commands from the operator using a radio controller or by using a control algorithm, the operator giving the agents a set of instructions consisting of a set of waypoints and commands specific for every agent. Each agent is equipped with cameras, a wireless 5.8 GHz transmitter, a 2.4 GHz transceiver and a Raspberry Pi that allows localized image processing when the agent is unable to reach the command center via normal means of communication due to interferences from the environment. This paper focuses on the radio network and the algorithms that allow the agents to communicate with each other in the absence of a command signal from the command center. They are developed using Python and C++ programming languages.

Keywords: Radio network, multi-agent system, RF24L01+, override signal.
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Development of Measurement Scales for Measuring Performance Value in the Market of Research, Development, and Innovation in Technical Science

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Abstract. An objective of research is development of a measurement scale for measuring customers' perception of performance value of products and services, provided in a market of research, development and innovation in the fields of technical science. The initial set of attributes that describe the performance value are "Quality and reliability", "Warranties and guaran-tees", and "Time of delivery". A psychometric adequacy of the initial set of sixteen manifest variables has been assessed for their reliability, convergent and discriminant validity and unidimensionality. Cronbach Alpha coefficient and Item-Total Correlation, exploratory and confirmatory factor analysis have been implemented to assess a psychometric adequacy of scales. The research results indicate that performance value is represented by two attributes, not three as initially hypothesized. They are "Quality and reliability" to which the warranties and guarantees items converged, and "Time of delivery". The developed measurement scales that reflect the attributes of the performance value consist of ten items (seven and three items, respectively). Both measurement scales possess adequate psychometric characteristics and are confirmed for their reliability, convergent and discriminant validity and unidimensionality.

Keywords: Performance Value, Quality and Reliability, Time of Delivery.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_23

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Mathematical Model for Calculating Heat Exchange

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Abstract. In this paper, possibility the results of research to determine the in-fluence of charge heating modes before loading into the furnace on the quality of the resulting melt are presented. The results of research and recommendations on heating the charge to reduce gas and oxide inclusions during melting in various furnaces are given.

Keywords: Alloys, Gas inclusions, Oxide inclusions.
Full paper available here: https://link.springer.com/chapter/10.1007/978-3-030-83368-8_24

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Technologies for Thin Layers on Ceramics Substrate

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Abstract. Reliability of thin layer deposition technologies and of characterization of their properties is very important to ensure high yield of the fabrication and a final product of high quality. In this paper, several

technologies for thin layer deposition like vacuum evaporation and chemical depositions from solutions, applied for metal electrodes on alumina (alpha-corundum, α-Al_2O_3) substrate, have been studied. XRD (X-Ray Diffraction) and AFM (Atomic Force Microscopy) have been used to characterize the structural and morphological properties of the analysed metal thin films/ceramic substrate.

Keywords: Thin Layer, Ceramic Substrate, Reliable Electrode.
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Flexural Test of 3D Printed Mecanum Rollers

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Abstract. 3D printing technology has grown up each year and its applications can be used in various fields such as manufacturing, robotics, medicine and custom art. An entry level consumer priced 3D printer, Prusa MK3S and a highly productive system for Additive Manufacturing Formiga P 110 were used to print the mecanum rollers with different setups. The purpose of this test is to determine the strength of the rollers used in the mecanum wheels assembly depending on the raw material and the load applied on the during the operation. Among various 3D printed approaches, fused deposition modeling (FDM) and selective laser sintering (SLS) were the one used in this paper to highlight the differences between the materials, in terms of density and resistance. To gain a better tolerance of various types of forces and better strength properties at low densities, the gyroid structure was incorporated in the 3D's infill model to combine both stiffness and printing speed. The flexural tests were conducted with Universal Testing Machine H10KT by applying an axial force on the transverse surface of the roll and by using the QMAT program software, the graphs have been outlined.

Keywords: 3D Printing, Mecanum, Fused Deposition Modeling, Selective Laser Sintering, Gyroid Structure, Flexural Test, Additive manufacturing
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Predictive Motor Speed Control for an Industrial Robot. A Dead-beat Approach

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Abstract. This paper presents the design of a predictive speed control structure, for a Direct-Current Motor that drives the forward and backward movement of an industrial manipulator. The described manipulator performs discharging actions to extract preheated round billets from inside the rotary hearth furnace and continue the hot rolling process. The mathematical model of the DC motor is obtained as a continuous transfer function, and all the necessary components of the control structure are modelled along with the driving motor. The paper focuses on the Dead-beat algorithm since such a method generates a predictive control structure quite effortless, requiring a second order system without time delay for the technological

process to be controlled. Such a form is easily obtained for de DC motor assembly, thus the predictive control structure yields, having two controllers: a direct path controller and a feedback path controller. The designed control structure follows the assumption that the future value of the output signal (the motor's speed) equals the value of the prescribed reference signal. The proposed control structure is validated via simulation, using MATLAB computer soft-ware, using both the reduced mathematical model and the extended implementation for the technological process to be controlled, namely the speed of the DC motor that drives the discharging manipulator.

Keywords: Industrial manipulator, Dead-beat method, Discrete control, Mo-tor speed, Predictive control, Computer simulation.

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Mathematical Model of the Stress State of the Antenna Radome Joint with the Load-Bearing Edging of the Skin Cutout

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Abstract. Using an adhesive to join radiotransparent radomes with the cutout edging in the skin or with the airframe has several advantages as compared to other kinds of joining. Adhesive joints are maintainable, airtight, and their weight is small and the aerodynamic efficiency is high. Known analytical models enable finding the stress state of rectangular joints, in which the stresses are distributed uniformly across the joint width. The objective of the paper is to investigate the axisymmetrical stress state of the adhesive joint of a circular plate with a rigid edging. The plate is subjected to uniform pressure across the surface. The adhesive layer, functioning under shear and cleavage, is considered as a Winkler elastic foundation. The edging and plate are assumed isotropic and are made of dissimilar materials with different thicknesses. The structure considered has two areas: the adhesive joint area and the area beyond the joint – the overlay on the cutout. The problem for the adhesive joint area is reduced to a system of two differential equations for tangential and cleavage stresses in the adhesive. The problem solution is built in analytical form. Unknown coefficients are found from boundary conditions and the conjunction conditions on the edges of the areas. The problem considered for the first time is the generalisation of the classical Goland–Reissner model of an adhesive joint for an area with radial symmetry. Com-putational results demonstrated a good agreement with finite element analysis calculations, indicating that the suggested mathematical model is adequate.

Keywords: Adhesive Joint, Axisymmetrical Model, Analytical Solution, Circular Plate

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Intelligent Network for Measuring Natural Environment Parameters

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Abstract. The paper presents the conceptual model and the experimental model (proof of concept) for a local network composed of intelligent nodes having multiple functions, grouped into distinct categories. The first category deals with air temperature and humidity data acquisition, as a result of direct measurement or interfacing with external equipment. Data are stored in local and remote databases. The second category involves real-time image streaming. The third category of processing refers to the possibility of digital I/O interface with external equipment, for monitoring and control. The role of each node is determined by hardware configurations and the running software ap-plications. The network contains also the web page server and the database server. The proof of concept is made by using various Raspberry PI boards as network nodes. Data visualization is carried out by accessing the web pages hosted by the web server. The obtained results lead to the optimistic approach of some future developments, especially to the monitoring and control of an external equipment.
Keywords: Intelligent network, Data acquisition and storage, Information Technology.
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Compression Testing of PA2200 Additive Manufactured Lattice Structures

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Abstract. This paper wishes to provide an extensive vision on how several designing and manufacturing factors affect the mechanical properties for lattice structures. This experiment shows how dynamic is the additive manufacturing technology and how versatile it is for different application. There were manufactured five specimens for different topologies (diamond, octet and cubic geometries, with a 60% porosity and different dimension) and different manufacturing factors (layer thickness and building orientation). The compressive testing shows a similarity for 2 geometries and a different be-haviour for another. Some of the results represents a starting point for future research in the additive manufacturing of plastics field.
Keywords: Lattice structures, compression testing, SLS, Young modulus, PA2200
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The Use of CPS for Assistive Technologies

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Abstract. In aging society, a number of individuals cannot perform normal daily activities because they have not enough physical strength. Elderly people, which have low mobility and do not stay at hospital, can perform daily activity only with the aid of caregivers. Although the recent pandemic situation has drastically modified global scenarios, even in this new and challenging situation, there is the need of developing suitable solutions for increasing the autonomy of fragile people in daily –life activities that can be performed at home. The new concept of Cyber Physical- Systems (CPS), which has been introduced mainly in the industrial context, pervades new domains, such as manufacturing, transportation, medical, military, and many others. This paper deals with the use of a CPS for a STS (Sit-To-Stand) device, which serves for an essential operation consisting in the movement for transitioning from sitting to standing postures. We have focused the attention on that specific task because it is crucial for daily life and has clinical significance, since higher STS movement ability may enhance the quality of life.
Keywords: Mechatronics, Assisting Technology, Assisting Device, CPS, STS.
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Mathematical Modeling and Simulation in Sheet Hydroforming Process for the Parts of Space Shape

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Abstract. This paper presents the research results on mathematical modeling and forming simulation in sheet hydroforming (SHF) process of a hollow spherical part from AISI 1010 steel. The paper used Deform 2D software for the simulation process. The results are intended to evaluate the influence of the process parameters such as forming pressure q (55MPa, 60MPa, 65MPa, 70MPa), die radius R (9mm, 12mm, 15mm), coefficient of friction f (0.08, 0.10, 0.12, 0.15, 0.2) on the degree of thinning of wall thickness ΔS. Based on the research results allow to determine the reasonable process parameters that improve the degree of thinning of wall thickness in SHF process of a hollow spherical part for the parts of space shape.
Keywords: Forming simulation, Forming pressure, Coefficient of friction, Die Radius, Degree of thinning, Hollow spherical part.
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Approach to Product Quality Requirements in the Context of Aeronautical Domain Process Modeling

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Abstract. Structural components account for a significant proportion of the number of components in an aircraft. The manufacturing methods and techniques by which these products are made, are considered critically, due to the importance of components. The volume and complexity of the requirements of each product are quite high. The intend of this research is to ad-dress the interaction of the product requirements in the manufacturing phase, when the value of the product increases the most, reason why the interest is highest. The requirements regarding the realization of the manufacturing pro-cesses, specific to the aerospace field, aim at the technological process parameters and are requirements generated by the need for indirect control of the products over the entire manufacturing process. The entire study was conducted based on their own views by identifying the need to analyze the requirements of structural products in the aeronautical field. The aim was to identify opportunities to improve engineering processes within industrial organizations, by establishing the link between quality requirements, technical resources knowledge and processes.

Keywords: Requirements, Product Quality, Metallic Structural Component, Aeronautical Field, Engineering Processes.

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Pulsed Fiber Laser Surfaces Micro-processing- Optimization and Applications

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Abstract. In this paper we present some considerations regarding the design, realization and testing of a modular, easy to use and reliable laser micro-processing system for high quality processing of various materials. The central part of micro-processing system is a 100 W pulsed fiber laser with 1064 nm wavelength. This system has been tested for cleaning and marking of different metallic and non-metallic materials. The experiments performed followed the analysis of the impact of a laser beam interaction, with selected operational parameters, on the quality of surfaces processing (cleaning or marking). The aim is to obtain sets of optimal parameters for different material processing in various applications.

Keywords: Laser material processing, Laser cleaning, Laser marking, Fiber laser, Laser parameters

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