

## 2D P COLONIES USED IN HYDROLOGY SIMULATIONS

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### ABSTRACT

We continue the investigation of 2D P colonies introduced as a class of abstract parallel rule-based computing systems composed of independent agents, acting and evolving in a shared 2D environment where the agents are located. Agents have limited information about the contents of the environment where they can move in four directions. Behaviour of each agent is based on its set of programs. The programs are formed from two rules of type rewriting, communication or movement. Although the colony is a theoretical computing model through 2D, it is a suitable tool for modelling the behaviour of natural multi-agent systems – colonies of bacteria or ants, spreading substances in homogeneous and non-homogeneous medium. In this paper we present hydrological modelling flow of liquid over the Earth's surface using 2D P colonies. Based on the entered data we simulate the fluid distribution in the environment.

**Keywords:** membrane systems, rule-based systems, parallel systems, 2D P Colonies, hydrology simulations, surface run-off

## **A HORIZONTAL FRAGMENTATION ALGORITHM FOR DISTRIBUTED DATABASES**

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### **ABSTRACT**

In this paper we present a horizontal fragmentation algorithm for design phase of a distributed databases. Our results has implemented in case of university databases application. We propose a matrix with values for attributes is used by the database administrator in the requirement analysis phase of system development life cycle for making decision of data mapping to different locations. Our matrix name is SIDU (S - Select, I - Insert D - Delete, and U - Update). It is a table constructed by placing predicates of attributes of a relation as the rows and applications of the sites of a DDBMS as the columns. We have used SIDU to generate ACF array with values for each relation. We treated cost as the effort of access and modification of a particular attribute of a relation by an application from a particular site.

**Keywords:** distributed databases, horizontal fragmentation, algorithm, attribute frequency matrix.

**AN INFORMATION SYSTEM FOR THE SUPPORT OF LAND-USE  
SOLUTIONS FOR AREAS AFFECTED BY MINING ACTIVITIES IN THE  
REGION OF UPPER SILESIA**

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**ABSTRACT**

Upper Silesia is an area lying at the Czech-Polish border, characterized by heavy industry, extensive past and on-going underground coal mining and open-pit mining of other natural resources. The region is also a locus of coke production and metallurgy. The existence of the heavy industry places an ecological burden on the landscape and the region, producing the need for land rehabilitation allowing its reuse. There are a number of reclamation processes and solutions underway to rehabilitate the disturbed landscape. Managers and institutions dealing with land reclamation and rehabilitation needing to decide on the most suitable procedure for a particular site will benefit from our information system that enables them to create landscape and rehabilitation models including visualisation. The system gives users a tool that supports the visualisation of possible solutions to help them decide on the most suitable method. The general design procedure supported by the system was introduced to the public at the SGEM 2011 conference and the procedures for model landscapes were published at the SGEM 2013 conference. This article builds on this work and provides an overview of processes, methods and tools used to design an information system for the support of land rehabilitation in the region of Upper Silesia.

**Keywords:** Information system, landscape visualization, GIS, land reclamation, SPOLCZECH, Upper Silesia

## ANALYSIS OF METHODS AND SYSTEMS FOR FUZZY DUPLICATE DETECTION

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### ABSTRACT

In the paper we discuss the problem of fuzzy duplicate texts detecting. We give the basic methods and algorithms to detection of full and fuzzy text duplicates, such as Wagner and Fisher, Masek and Paterson, Ukkonen, suffix tree, Bitap, n-grams, shingles, hashing by signature, I-Match signature, TF\*IDF etc. The characteristics of algorithms to fuzzy duplicate detections are shown. We review the existing systems of duplicate texts detecting used for Russian and English languages. The benefits and disadvantages of such systems are described. Existing systems check text duplications only in the internal database or in the Internet. To better search, the system must operate with both types of sources.

**Keywords:** text, duplicate, method, system, fuzzy duplicate.

## APPLICATION OF AUGMENTED REALITY IN MINING INDUSTRY

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### ABSTRACT

The article follows many years of experience of the Virtual Reality Laboratory at the Faculty of Mining and Geology of the VŠB - TUO. In our paper we follow the trend of incorporating modern means of automation and visualization using augmented reality (AR hereafter) in the raw material industry processes. We deal with such applications when the coal miner himself or the machinery used are equipped with head-mount display or intelligent glasses which display information optimizing his performance and increasing safety. The article is primarily concerned with presenting information in a way that greatly supports decision-making processes, such as applications related to navigation in the mine environment, new teaching methods for work with mining equipment, display of real-time information to facilitate work, training in mine safety, prevention of mining accidents and other. When uncovering the potential of AR we conducted a series of experiments confirming the applicability of these technologies. For experiments with augmented and virtual reality we used the programming environment Metaio and Unity and for visualization of devices the Oculus Rift development kit.

**Keywords:** 3D Virtual model, Augmented reality, Virtual reality

**ASSESSING THE SAFETY LEVEL OF TECHNICAL EQUIPMENT  
OPERATING IN POTENTIALLY EXPLOSIVE ATMOSPHERES BY USING  
COMPUTER MODELLING**

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**ABSTRACT**

In technological installations from the oil and gas industries used for the extraction, processing, storage or delivery of flammable substances, there may occur explosive atmospheres. An explosion, followed or not by a fire is a destructive phenomenon with major social and economic involvements, especially for the current technologies. It is a complex phenomenon with unpredictable evolution which includes chemical and physical processes such as burning reactions, heat transfer, flame formation, exchange of gases with the environment, structural transformation of building materials and resistance elements. In any work system, but especially in the oil and gas industry, the explosion risk factors are gases, vapors, mists, flammable aerosols, which through air dispersion may generate flammable mixtures. Explosive mixtures overlapping in time with an efficient ignition source generate explosions. Within the occupational health and safety, the explosion risk assessment has as main purpose to generate measures for preventing and limiting the effects of the explosions. For carrying out the explosion risk assessment, several steps are required, one of them being the classification of hazardous areas. In order to avoid the occurrence of an explosive atmosphere, there has to be prevented the release of flammable materials from their storage or processing system and to be insulated from the outside air. In installations from the gas industry technical equipment may be considered release sources. This paper aims to use modern CFD techniques for modelling several types of technical equipment which may be considered release sources within a gas drying installation. These models will be split into finite volumes, the so called mesh, which is the second part of the CFD analysis to be carried out. In future researches, the designed and meshed geometries will be used for estimating the gas release rate for several scenarios.

**Keywords:** CFD, explosive atmosphere, modelling, safety level, technical equipment

## **AUTOMATED SYSTEMS AND INDUSTRIAL ROBOTS REMOTE CONTROL**

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### **ABSTRACT**

Within this article we analyze the problems of modern industrial automation system. We review a number of automated devices and industrial robots, introduced at the production operation and analyze the advantages of the control and monitoring methods for those systems.

This article contains a detailed examination and analysis of remote control method. Based on the set up experiment for the industrial sorting rectangular remote control we provide you the advantages of such a mean of communication.

**Keywords:** automation, remote control, remote monitoring, robot, controller, Wi-Fi block, LEGO NXT.

**AUTOMATIC RECONSTRUCTION OF THREE-DIMENSIONAL OBJECTS  
USING PATTERNS FOR CAD-SYSTEMS**

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**ABSTRACT**

Tasks of automatic reconstruction of three-dimensional objects from orthogonal projections are actual for CAD. This paper summarizes the existing approaches to reconstruction from projections drawing. The algorithm is based on a boundary representation of three-dimensional models. The algorithm consists of the following steps: automatic separation of the drawing per the views, determination of three-dimensional coordinates of vertices, definition and marking of wire model primitives, reconstruction of model faces and model elements. The algorithm uses patterns for the reconstruction of typical structural elements of the model. Patterns of standard elements are given in the form of adjacency matrix. The developed algorithm processes the data format DXF. The results of the system are presented.

**Keywords:** three-dimensional reconstruction, CAD-system

**BIG DATA AND MULTIDIMENSIONAL ANALYSES WITH SPATIAL DATA****Jakub Otrzasek, Wojciech Mueller****Krzysztof Koszela, Jerzy Weres****Jacek Przybyl**University of live Sciences in Poznan, **Poland****ABSTRACT**

In this article, the authors concentrate primarily on free-of-charge Big Data dedicated solutions (Apache Flume, Hadoop PostGreSQL) and attempt to combine them with commercial programs offered by Microsoft, including SQL Server 2012/2014, with geospatial type libraries ready to use on the .Net platform. It is worth mentioning that geospatial types are also available in free-of-charge versions of SQL Server Express Edition (as well as other providers' RDBMS, e.g. PostGreSQL). The presented solution uses a spectrum of various platforms, including the SSAS platform (Sql Server Analysis Services), constituting a part of MS SQL Server in its chargeable version (min. standard).

**Keywords:** SSAS, SQL Server, Spatial data, Excel, PivotTable, Spatial Analysis, SOLAP, OLAP, MultidimensionalCubes, MDX

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## COMPARISON OF DATABASE MIRRORS TECHNOLOGY OF THE SELECTED DATABASE SYSTEMS FOR USE IN FAULT-TOLERANT INFORMATION SYSTEMS SOLUTIONS

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### ABSTRACT

The technological process control in the raw-material industry, which often operates in continuous mode 7x24, requires high robustness and safe operation. It was created a category of systems so-called fault-tolerant. The solution of system to be a fault-tolerant is in duplication of the entire system. In case of failure of any component of the production system the backup system takes control and ensures the continuous operation of the information (or control) system. A critical component of such solutions is to ensure the continuity of data in databases. Data taken from technological processes have the character of the time series and in case of failure missing data substantially disrupts the evaluation of balance of production. The solution to this problem is to use a database mirror technology for continuous on-line data mirroring between two instances of the database server. In the past we have used technology of Microsoft SQL Server mirroring solution with fault-tolerant system for Darkov Coal Mine coal preparation plant. This year we have started research the possibility of using database technology mirror the world's leading manufacturers of database systems - Oracle, Microsoft SQL Server, MySQL and Caché - to simulate critical failures and determine behavior and immunity of systems against failure. Based on the tests we have an aim to propose the best solutions and best practices for deployment in fault-tolerant information systems for production control.

**Keywords:** database mirror, fault-tolerant system, MES, Microsoft SQL Server, Oracle.

## COMPARISON OF THE RESULTS OF LAMINAR AND TURBULENT FLOW OF METHANE IN POROUS MEDIA

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### ABSTRACT

Modeling and simulation of flow using CFD packages is an interdisciplinary task, in which a person must have knowledge of investigating phenomenon not only in the field, which is dealt with, but mainly from fluid mechanics. In the case of modeling and simulation of mine gases flow in porous medium is one of many important steps decision whether the flow in rocks has laminar or turbulent character.

This article aims to identify and compare the results of modeling and simulation using laminar and turbulent flow in the modeling and simulation of phenomena in the field of gas flow through porous environment and evaluate whether there are significant differences between these two types of flow.

The next task is to answer the question whether the amount of the mixture flowing wellhead linearly dependent on the size of the underpressure induced in the borehole.

**Keywords:** laminar flow, turbulent flow, modeling and simulation, methane, porous environment

## COMPETENCY-BASED MANAGEMENT OF INFORMATION FLOWS IN CONSTRUCTION PROJECTS

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### ABSTRACT

New technologies, methods and techniques in designing, project planning and project realization are used across the wide range of construction processes during the lifecycle of construction projects. These factors have significantly increased the amount of information that professionals in the construction industry need to identify, acquire and use in their job. There is also a growing need for competency based management, especially with the increasing number of stakeholders in construction project. They have different interests and a lot of information flows and processes arise between them. The increasing importance of information management and integration requires the information strategy aligned with social and technical competencies of project managers. The aim of the of the paper is to show the potential of information and communication technologies together with competency based management for developing effective information flows and partner relationships between construction companies and other parties in the construction.

**Keywords:** information management, ICT, information flows, construction projects, competencies of project managers

## CONNECTING AIR MOBILE AND DESKTOP APPLICATIONS WITH SOCIAL NETWORKS

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### ABSTRACT

Connecting with social networks has become an essential part of the process of mobile and desktop application development. Lots of applications, especially the mobile applications are using different authentication methods to authenticate their users and store the user data into their database. The method of authentication using social networks has proved to be very effective in many different ways. The main benefit of using this method is time-saving and avoidance of the registration process. Users prefer to use their profiles on social networks for registration on a web-based system rather than creating a separate user account. This paper provides tips for connecting AIR mobile and desktop applications with Facebook using ActionScript Graph API. The paper is divided in two parts. The first part is about connecting mobile applications with Facebook using Facebook Mobile ActionScript API. In this part we are focused on giving clear guidance for the process of authentication using access token and it is elimination of potential barriers during the process of implementation. Also, very important to mention that this method is cross-platform oriented. That means that the mobile application will be suitable across many different devices and platforms. This also raises the need of analyzing the rendering of HTML content across mobile devices using ActionScript. The second part of the paper covers the desktop AIR applications and the connection with social networks on desktop systems which is less used method but just as effective as in mobile systems.

**Keywords:** Flex, Adobe AIR, social networks, authentication, user, profile

**DESIGNING A WORK ENVIRONMENT USING AN ERGONOMIC  
APPLICATION MODEL OF THE PROCESS OF LATHING TWO-WHEEL  
ASSEMBLIES**

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**ABSTRACT**

It is known that long-term repetitive movements in an unsuitable work environment have unfavourable effects on the human body. Designing a work environment in a complex man-machine-environment system is therefore an important task. The article is focused on the creation of optimal conditions for the performance and safety of a worker with the goal of ensuring preservation of his health, i.e. his physical, mental and social satisfaction. The main part is resolved through application of a model for designing a work environment for the lathing of a two-wheel assembly, with an emphasis on primary principles when designing systems with the goal of minimizing the burden put on workers and thus increasing safety and quality – of ergonomic conditions and noise. In the article a method for assessing noise is proposed while keeping not only legislative requirements in mind but also the non-auditory effects of noise (consequences on the cardiovascular system) caused by the fact that the hearing organs are not the only areas affected by noise.

**Keywords:** noise, human factor, ergonomics, safety, maintenance, lathe work

**DEVELOPMENT OF ALGORITHM FOR LOCALIZATION OF PRODUCTION  
MARKINGS WITH THE USE OF ANALYSIS OF THE COLOR DATA ON  
DIGITAL IMAGES**

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**ABSTRACT**

The article shows relevance of design and implementation of systems of localization of production markings on digital images. The analysis, description and comparison of this class of systems is performed. In the course of conducting a comprehensive analysis, the main characteristics of the systems under consideration are identified and existing software systems are analyzed. The results of estimates of the characteristics of the systems on the example of localization systems of state license plates are given. The algorithm for localization of production markings with the use of analysis of the color data on digital images is developed.

**Keywords:** localization, production markings, digital images, color data/

## DEVELOPMENT OF LABORATORY WORK FOR REMOTE ACCESS LABORATORY

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### **ABSTRACT**

This paper proposes an approach to the development of laboratory research courses for industrial interfaces. The National Instruments laboratory complex and the iLab software by Massachusetts Institute of Technology are used as the material and technical base of the research, which provide a platform to introduce students to the concept of virtual laboratories in general, and to the use of industrial interfaces in particular.

Using hybrid laboratories in the educational process will on the one hand enable the student to perform experiments with equipment and material, to gain practical skills in experiments conducting, and to familiarize oneself in detail with a computer model of a unique object without the risk of costly equipment damage or bodily injury. On the other hand, the connection of existing laboratory equipment and devices via the Internet in a hybrid laboratory allows the laboratory activity to be moved to a new level, where multiple students might simultaneously conduct laboratory work remotely and have a more flexible schedule, which would be hardly feasible in the traditional laboratory work.

**Keywords:** virtual laboratory researches, industrial interfaces, remote access laboratories, e-learning, distance learning technologies.

## DIGITAL THERMAL SENSOR FOR FPGA LOCAL AREA BASED ON MONTE-CARLO METHOD

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### ABSTRACT

The article covers temperature measurement in systems on chip. The main scientific result, obtained by the authors, is the development of digital temperature sensor circuit, which can be coded with HDL languages (e.g. VHDL or Verilog HDL) and implemented in design on RTL design stage. The sensor has fully digital design, same as most FPGA devices. So, it is not necessary to implement extra dedicated units in FPGA devices. Using these sensors in ASIC designs removes the necessity to combine analog and digital design. The circuit can be implemented on one technological process stage. Moreover, placement and routing of entire unit, including the sensing part, can be performed automatically. The main operating principle of the sensor is based on estimation of signal propagation delay through the logic cell, which depends on the temperature. The propagation delay is evaluated by Monte-Carlo method. In the article, we prove the possibility to use periodic signals as pseudo-random, make the structural and functional description of the proposed sensor and present the results of its experimental implementation, as well as sensor network implementation for local overheating detection.

**Keywords:** TDC, FPGA, SoC, temperature sensor, ring oscillator

## DISPATCHING CENTRES AND THEIR INFORMATION SUPPORT

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### ABSTRACT

This paper deals with the safety of data transmitted between database servers and the central control system (CCS). An important feature of CCS is providing the necessary information in real time, therefore there is a need to ensure data consistency. The main objective of this article is to outline the options of ensuring data consistency via database server mirroring and throughout the transmission from the servers to CCS.

**Keywords:** dispatching centre; control of technological processes; databases; data safety; information support

## **DNA ENCRYPTION FOR DATA TRANSMISSION AND STORAGE SECURITY IN INDUSTRIAL ENVIRONMENTS**

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### **ABSTRACT**

Data security has been a major concern for people since the first forms of written communication were developed and, as societies progressed, more and more advanced encryption methods were designed. In this paper, one studies a new approach to industrial data encryption using DNA strands in order to transmit and store secret data. There are presented the theoretical principles of a DNA-based encryption method, on two levels: classical encryption with Playfair cipher and, then, insert of the encrypted message in a seemingly normal DNA molecule. Due to the fact that it was not possible to perform experimental tests in real conditions, a mobile application was developed, in order to encrypt, transmit and decrypt a message, using Java programming language for an Android operating system.

**Keywords:** DNA encryption, security, data transmission and storage.

**EDUCATION SUPPORT FOR MATHEMATICAL LOGIC;  
THE ELOGIKA SYSTEM**

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**ABSTRACT**

In this paper we introduce the Learning Management System (LMS) eLogika that has been developed for teaching mathematical logic. The eLogika system is a web application that provides didactic material for courses on mathematical logic. Its main goal is an automatic test generation and computer-aided test evaluation based on a large database of exercises. The system makes it possible to adjust the level of particular tests according to students' knowledge level. To this end we developed a feedback module that makes use of statistics and data mining methods. The system can generate a large number of training as well as exam test variants for each common thematic topic. At the same time it provides effective semi-automatic methods of test rating and evaluation. Since we aim at students' active work with the system whenever and wherever needed, authentication is an important issue. To this end we exploit three ways of identification, namely biometrics (in particular face recognition), near field communication (NFC) and finger print recognition. Though the latter has been implemented as well, it turned out that in practice this method is not favourable and we do not use it. The face recognition method is applicable and useful in particular for distant students who execute online tests at home without the need to physically come to the university. The NFC method makes use of the fact that current mobiles are equipped with NFC chips. Thus it is easy to recognize students, generate a specific test for them and immediately print the test.

**Keywords:** E-learning, logic, authentication, biometrics, face recognition

## **EFFECT OF MESH DENSITY ON THE ACCURACY OF THE CALCULATION USING CFD**

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### **ABSTRACT**

One of the important steps in the modeling and simulation of phenomena using CFD codes is the creation of geometry, respectively creating a mesh for the investigated area. Modeling and simulation of phenomena in Fluent CFD tool required the discretization of area to cells at the beginning - finite volume method.

From this perspective, it is very important to prepare high-quality mesh for modeling. The mesh plays a very important role for the calculation of the modeling and simulation, and is thus necessary to find an optimal balance between the number of cells and the hardware requirements for computing, which brings with it the number of cells.

The paper deals with application of CFD codes in mining and in especially we compare the calculation modeling and simulation on several models with different quality network. The aim of this article is to determine the specific examples of how the cell density significantly affects the calculation itself.

**Keywords:** modeling and simulation, methane, porous environment, mesh quality, CFD, Fluent

**EVALUATION OF ELECTRICAL PARAMETERS OF INTRINSIC SAFETY  
BARRIERS OF THE ELECTRICAL EQUIPMENT INTENDED TO BE USED  
IN ATMOSPHERES WITH EXPLOSION HAZARD**

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**ABSTRACT**

In the past few years, high-level scientific languages such as Matlab have become more and more popular for both research and educational purposes. Matlab has been proven to be one of the best software packages which lead to good results in the field of electrical engineering analysis. Electrical equipment which operate in potentially hazardous environments are externally connected through intrinsic safety barriers. Their gauging should observe the safety standards in the field and it is made on grounds of a theoretical analysis, which is focused in this paper. The analysis of the safety barrier involves the consideration of two important regimes: the a-periodic and the oscillatory regime. The safety barrier is studied when connected to a DC and AC voltage. In this purpose, a theoretical analysis of the barrier was made, in which the uniformly distributed parameters were considered to be concentrated. For each situation mentioned above, the analytical expressions of the output voltage and of the current through the barrier were inferred. SimPowerSystems in part of Matlab Simulink and it operates in Simulink environment. The safety barrier is analysed in Matlab environment, through numerical simulation in Simulink.

**Keywords:** a-periodic regime, intrinsic safety, oscillating regime, safety barrier, SimPowerSystems

## EXPLORING PROGRAMS FOR INVARIANTS OF A FEW DISCRETE TRANSFORMS WITH RANDOM NUMBERS TRIALS

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### ABSTRACT

In this paper, we will expose the algorithms for constructing the invariant sequences for a few discrete transforms. Such sequences are their fixed points and therefore they are of the special concerning. Especially, we consider binomial, invert, Catalan and Hankel transform of number sequences. Indicated considerations are illustrated by examples.

**Keywords:** Sequences, invariants, binomial transform, Hankel determinants.

## FOTOM<sup>NG</sup> SYSTEM, ARCHITECTURE, FEATURES

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### **ABSTRACT**

System FOTOM<sup>NG</sup> is digital image processing application developed by scientists of VŠB TU Ostrava (faculty of engineering and computer science). The application was originally implemented as stand-alone non-modular software without accessible API, [1]. Based on emerging requirements there was developed next generation of the system which is fully modular created using most recent approaches on a modern development platform. The next revolutionary version of FOTOM<sup>NG</sup> with brand new application core and published API makes it much more universal and easily extensible.

FOTOM<sup>NG</sup> contains three essential set of tools: area definition tools, sketch&filter tools, measurement tools. System FOTOM<sup>NG</sup> contains as well several important modules and functions like: image calibration and transformation module, module for 2D animation of measurement process /2D modeling of measurement process, integrated AVI video recorder, which is able to capture and store images based on ECG chart events, module for advanced object recognition (recognition of brainstem, profile of carotid arteries, etc.), large set of image filters, active contours methods using Gradient Vector Flow and Fast Marching Sets, image stitching module used to synthesize clean and sharp image out of several blurred/damaged images.

**Keywords:** animation, modeling, active contour, architecture, edge detection, ECG fast marching, Phase correlation, filter, photogrammetry, FOTOM, GVF, Java, calibration, level set, thresholding, projection, registration, transformation, video, object of interest

## **GENERATING RAINFALL-RUNOFF DATA COLLECTION FOR CALIBRATION OF MACHINE LEARNING DRIVEN MODELS**

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### **ABSTRACT**

Machine learning driven models provide a useful alternative for analytic modeling software in many domains. Simulating the rainfall-runoff process (i.e. transforming the fallen precipitations into the runoff in the corresponding outlet) is no exception and there are a lot of machine learning alternatives such as case-based reasoning, artificial neural networks etc. To facilitate their proper function, it is necessary to correctly set up the algorithm parameters or to provide a meaningful training data collection. However, in some areas, where the floods are not very frequent, it can be almost impossible to obtain the required combination of input measured precipitations amount and the corresponding measured output discharge in the outlet. In such case, the utilization of analytic modeling software (such as HEC-HMS, MIKESHE, HBV etc.) can be very helpful. This paper describes in detail our procedure for generating desirable data collection using such software including distorting of inputs and concatenation of partial results. It also clarifies the usage of verified rainfall-runoff model (the Floreon<sup>+</sup> system) and selection of studied area (Odra catchment).

**Keywords:** machine learning, time series, rainfall-runoff model, training data, floods

## **HARDWARE VIOLATION MONITOR OF TRANSACTION LEVEL REAL-TIME CONSTRAINTS FOR RELIABLE SYSTEMS ON A CHIP**

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### **ABSTRACT**

The paper deals with hard real-time constraints issue while developing reliable systems on chip (SoC). The emphasis is focused on evaluation of time constraints monitoring approaches at the chip prototyping stage (FPGA or ASIC). The authors propose a new method of real-time constraints formal description at the transaction level. The hardware violation monitor based on the proposed approach has been developed and results of its experimental implementation are shown in the article. This monitor is possible to be implemented in SoCs based on such common bus architectures like AMBA, OCP and WISHBONE.

**Keywords:** SoC, real-time constraints, hardware checkers, temporal logic, model checking.

## HLD METHODOLOGY: THE ROLE OF ARCHITECTURAL ABSTRACTIONS IN EMBEDDED SYSTEMS DESIGN

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### ABSTRACT

Architectural complexity of embedded systems (ES) constantly grows, raising system design issues actuality.

In the article, HLD methodology of ES design (High level design methodology for embedded systems) is represented, which has been used in a number of applied projects and has shown the improvement of architectural and micro-architectural design quality. Its basis consists of the following things: architectural abstractions system; design process of the computer system architectural model, independent of hardware-software implementation; actualization model of computational process based on the unified translator concept; aspect model of computer system design process.

HLD methodology practical application solves, first of all, the following problems: reasonable distribution of computational process components on various phases of system life cycle (design-time, run-time), providing expansion of design space; architecture synthesis, based on a generalized view at computational mechanisms; possibility of late fixation of a certain implementation method of architectural decisions; flexible change of ES properties by means of configuration within the chosen subset of design aspects, which allows to control resource expenses on various phases of system life cycle (development, production, utilization, support).

HLD methodology considers ES, first of all, through a prism of its target computational process organization on design-time, config-time, run-time phases in the uniform way, inviting the developer to search the effective distribution of computational process elements on these phases. It includes a number of abstraction groups for working with ES components and ES as a whole, with ES design process and architectural decisions metrics.

In the article, HLD methodology principal propositions are presented, the system of architectural abstractions lying in its basis is examined in detail.

**Keywords:** embedded system; design methodology; computational architecture; system level design; reconfigurable architecture.

## INSTRUMENTAL CONTROL OF AVIONIC ERGATIC SYSTEM

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### **ABSTRACT**

Modern aircraft are equipped with airborne systems adjusted to receive and process a large amount of information which are important for a safe flight. Pilot cabins present workplaces which have a character of „symbiosis“ with the importance of self-realisation of biological and physical abilities of the pilot in connection with learning about cybernetic effects of aircraft features. The paper draws the attention to the principle of aircraft control, where the mutuality of the notion machine – man (or vice versa) is labelled by the term „ergatic“. Avionics is the tool, which enables to highlight the above mentioned mutuality (aviation electronics). The concept symbiotic cabin enables the operator – pilot (OP) in cooperation with the avionics to perform tasks, in which the aircraft and OP, i.e. AES (aviation ergatic system), present partnership equality conditioned by ergatic ability to decide about the quality of the aircraft control. From the point of view of the features of ergatic system, the inputs of OP into the laws of automatic powers and moments control have assistance function.

**Keywords:** symbiotic, sensor, model, skills, operator-pilot, ergatic system

## **INTELLECTUAL SUPPORT SYSTEM OF ADMINISTRATIVE DECISIONS IN THE BIG DISTRIBUTED GEOINFORMATION SYSTEMS**

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Assoc. Prof. Alexander Pupkov, Assoc. Prof. Roman Tsarev**  
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### **ABSTRACT**

In work the technique of increase of overall performance of geoinformation systems, by decrease in quantity of delays arising in it is offered. The problem of optimum utilization of resources in the distributed computing systems is considered. The dynamic mathematical model of utilization of resources in the distributed computing systems is described. Methods and algorithms for the optimum solution of this model are offered. Results of work of system of support of decision-making of optimum distribution of resources in the distributed geoinformation systems are presented.

**Keywords:** optimization, utilization of resources, system of support of the decision-making, the distributed computing systems.

## INTELLIGENT GENERATION OF WEIGHTED REAL-WORLD GRAPHS – AN EXPERIMENTAL STUDY

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### **ABSTRACT**

This paper deals with different approaches in the generation of weighted real-world graphs as the fundamental data structure for mathematical optimization algorithms. Based-on spatial data originating from the Austrian Digital Cadastral Map we examine three promising strategies to create valid graphs. The applicability of the constructed graphs is examined by solving the minimum Steiner tree problem as a typical representative in the design of wired communication networks.

**Keywords:** graph theory, graph generation, network optimization

## METHODOLOGICAL ASPECTS OF ERP (ENTERPRISE RESOURCE PLANNING) IMPLEMENTATION

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### **ABSTRACT**

The paper presents contemporary methodological approach of critical success factors in the implementation of management information systems. The most important elements of this problem based on thorough analysis of the latest research in the field of implementation of integrated information systems are presented. The paper presents a methodological review of the current actual situation of critical success factors in the companies and business systems, instructions and recommendations which management of the companies and business systems should adhere while introducing modern conceptual information systems.

**Keywords:** information systems, implementation, business systems

## **MOBILE CAMERA SYSTEM FOR ENSURING TRANSPORT SECURITY**

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### **ABSTRACT**

The camera systems are one of the most important attributes of systems designed for the transport security. Human factor obviously cannot monitor several places simultaneously from one position and focus on a detail from a great distance. It is consequently not possible to create a video recording that would be useful in clarifying various events or even as evidence. The mentioned facts declare the importance of monitoring devices directly in situations requiring an immediate solution. This paper describes a modern professional camera system Forbis Mobile Monitor which represents a successful innovation within the security industry because of its mobility, compactness, and configuration. As Slovak market researches declare this system is demanded for its low financial costs and high flexibility mainly in transport.

**Keywords:** mobile camera system, transport industry, flexibility of the monitoring system, transport security.

## **MODIFICATIONS OF THE PARTICLE SWARM OPTIMIZATION AND NEW PROPOSED VARIANT**

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### **ABSTRACT**

Particle swarm optimization (PSO) is a stochastic meta-heuristic computational technique which serves to find the best region of a multidimensional space. The method belongs to the group of evolutionary computation, to the subgroup of swarm intelligence. It is based on an iterative work with a population and mimics the movement of school of fish or flock of birds. The low number of parameters to adjust and easy implementation are the main benefits of the PSO method.

The main goal of this paper is to provide a comprehensive review about different variants of the particle swarm optimization. The original PSO algorithm is modified due to improve the optimization ability and to avoid the premature convergence to the local minimum. The parameter of inertia weight or constriction factor was implemented to the equation. In this paper, new modification of PSO algorithm is presented, where the velocity of individuals depends on the nearest neighbourhood of each particle. The comparison between the proposed algorithm and other existing methods is presented and discussed in the paper.

**Keywords:** PSO, swarm intelligence, inertia weight, constriction factor, global search

## MUTUAL COMPARISON OF THE SET OF ALGEBRAIC VECTORS USING WEB APPLICATION

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### ABSTRACT

The paper deals with design and implementation of a web application that is used to compare the elements of the set of  $n$  - component vectors using geometric structure of abstract spaces. In the introductory part analyses the reasons and described some methods for reducing multidimensional data, together with the areas of their use. The second part specifies the purpose of designing a web application, while the mutual comparing elements application uses a pair of orthogonal reference elements. Principle of solutions is a further part of this paper. The main attention is devoted to a description of the implementation of solutions web application as a whole and its various aspects. Further input parameters are specified application indicating their options and predefined values. The output of the application are the assigned coordinates of each input vectors in the three-dimensional Euclidean vector space. The application provides a simple graphical output. In the case of a defect or other problem is the output one of the error messages of application.. Finally, the contribution constitutes an example of the use and application possibilities of its use in various fields.

**Keywords:** web application, HTML, PHP, Hilbert space, vector quantization of space

## ONE WAY TO FUZZY DUPLICATES DETECTION

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### ABSTRACT

In paper considered the problem of fuzzy duplicate detecting. There are given the basic approaches to detection of text duplicates. We review the existing methods of fuzzy duplicate detection. The most famous is method of shingles. We present algorithm of fuzzy duplicate detection. Text of document is replaced by filtered copy. HTML tags, punctuation marks, special characters, stop words are deleted from document. It is done processing of replacement characters and stemming. Text is divided into a sequence of words. Length of sequence is fixed. For each sequence of words is computed MD5 code. The number of matching MD5 codes shows the measure of matching documents. If all codes in two documents are match, then documents are full duplicates. If there aren't match codes, then documents are different. If only part of MD5 codes is match, documents are fuzzy duplicates. The algorithm of fuzzy duplicate texts detection was implemented in system AVTOR.NET. In article the results of algorithm testing are given. Algorithm show good results for all types of tests.

**Keywords:** fuzzy duplicate, text, duplicate detection.

**POSSIBILITIES OF SAFETY IMPROVEMENT AND TRACEABILITY OF  
EMPLOYEES IN THE MINE ENVIRONMENT**

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**Ing. Pavel Staša, Ph.D.**

**Ing. Jiří Švub, Ph.D.**

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**ABSTRACT**

Automatic identification technology have been started to be more and more applied in many fields of human activities. This phenomenon is nowadays increased even in the fields where this technology is not primarily intended to be used. Our goal is to find synergies between the benefits that automatic identification technology provides and applicability of the mentioned technology in uncommon fields in order to reduce the occurrence of risky situations and improve safety and level of automation in the entire process. The paper deals with research and analysis of UHF RFID technology usability for the traceability of persons working in underground coal mines. Thanks to the application of the means of automatic identification (UHF RFID technology) we aim on the workers safety enhancement and unambiguous employees localization that is crucial for emergency situations, such as cave-ins, etc. Indisputable advantage of UHF RFID technology compared to other means of automatic identification is especially multiple IDs reading at one time and also the fact that there is no need for line of sight reading. With this it is possible to implement automatic localization technology in an environment where we are not able to use common positioning technologies such as GPS.

**Keywords:** RFID, positioning, mine

## **PROCESS CONTROL AND SYNCHRONIZATION PATTERNS FOR SOC**

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**Grad. stud. Alexander Antonov**

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### **ABSTRACT**

Nowadays “Systems on Chip” (SoCs) have become one of the main types of computer platforms. SoC design is based on parallel computing models, which map on architectures with primarily hardware implementation of computational process components. In the article, we propose the original architecture, based on modified model of Kahn process networks. The model of hardware-detached process interaction is described, as well as corresponding mechanism of inter-process communication channel management. In conclusion, we consider several hardware implementation patterns of proposed model elements. Proposition and estimations presented are proved by SoC design experience and results of several applied projects, completed by the authors.

**Keywords:** embedded systems, SoC, hardware-intensive, scheduling, process synchronization

**PROGRAM SOLUTION FOR A LIMIT PROBLEM  
WITH RANDOM NUMBERS TRIALS**

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**ABSTRACT**

In this paper, we consider the linear combinations of elements of two sequences: the first one a priori given nonnegative sequence and the second random sequence from the unit interval. We investigate the expected value of the smallest natural number such that the value of these linear combinations exceed a positive number. After very clear geometrical conclusions, we find the function which express the expected value. Here, we recognize a few known results like the special cases.

**Keywords:** experiment, expected value, probability, exponential function.

## **REAL-TIME ACQUISITION AND PROCESSING OF A VIBRATION SIGNAL**

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### **ABSTRACT**

This paper presents aspects of the implementation of a system for real-time acquisition and processing of vibration signal. The hardware was organized around a core microcontroller DS89C420, being able to execute a large number of instructions / second. The main problem that is trying to be solved is the acquisition of a vibration signal from a source that does not allow placement near a CISC processor system for processing. It presents as a compromise between the acquisition and processing in terms of real time.

**Keywords:** vibration signal, real-time data acquisition, real-time processing, deconvolution method.

## **RFID BASED ASSETS MANAGEMENT BENEFITS IN MINING INDUSTRY CONDITIONS**

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### **ABSTRACT**

The article deals with the research and analysis of the identification possibilities of equipment and assets of organizations engaged in mining and processing of mineral resources. The environment of underground mines is very specific and used equipment has to follow strict conditions, particularly with regard to intrinsic safety. Nowadays, there are UHF RFID devices in intrinsically safe version. All equipment that workers in underground mines use can be equipped with a safe RFID identifier. Due to this it is possible to manage the status of the items in mean of revisions of hazardous gas sensors, fire-extinguishers, self-rescue devices, filters in gas masks, first aid kits, etc. Our aim lies in reduction of the possibility of situations when a miner does not have the right equipment nor has the equipment that has not undergone proper safety check and may not be fully functional. Thanks to our intentions the worker could be surer that in a possible risk situation he would be properly prepared, equipped and can rely on his equipment.

**Keywords:** RFID, mine equipment, asset management, automation

## SMARTMODELS – A FRAMEWORK FOR GENERATING ON-LINE SALES MANAGEMENT SYSTEMS

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### ABSTRACT

Shopping online has set a strong mark on the marketplace today and on the way the new generation of youth and couples resource. Every supplier has to go online to market its offers for a wider customer community in order to stay on top.

One of the prime-time opportunities is to build web-based software solutions in order to support online sales. But there are so many types of products and patterns of marketing when thinking how to generate the content of a web page. GeoInformatics play a major role. Moreover, there are security concerns and all the operations that need management after the sales that the complexity of such a software system can be hard to implement and it can hardly foresee all future forms of such a business model.

This is one of the main concerns of the Object-Oriented Programming (OOP) principles which did not cure important issues faced by software companies these days on developing complex software for reuse and protecting the more and more evolving applications against technological obsolescence.

The Model-Driven Architecture (MDA) project from OMG promotes the use of meta-modeling in order to drive the system's design and implementation. In this context this paper presents:

- an approach: it reviews the SmartModels approach briefly introducing its principles, basic entities and main elements when defining a business-model;
- a prototype: SmartFactory which is based on Eclipse platform and its role is to validate the new approach. It addresses the paradigm of how to practically implement MDA principles and rules for software engineering. Therefore, it deals with important implementation issues based on Eclipse Platform.

In the world of software everything evolves: technologies, methodologies and applications. I believe that in order to provide an approach centered on models, which capture the know-how of a domain, it is of primary importance to ensure the independence between both the model and the software platform and between the model and the possible applications. This article promotes the idea that model-oriented programming is a better approach to solve these new challenges.

The examples in this paper target the process of developing a platform for the deployment of online sales management systems.

**Keywords:** meta-modeling, informatics, on-line booking systems, smartmodels, software product lines, genericity.

## **SOFTWARE PACKAGE DEVELOPMENT FOR MOBILE ROBOT CONTROL AND BEHAVIORAL TRAINING**

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**Assoc. Prof. Dr. Otilia Cangea**

**Lecturer Dr. Cristina Popa**

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### **ABSTRACT**

This paper presents a software package developed for controlling a mobile robot that can be used for indoor or/and outdoor applications. The system is a component of a project implemented at Petroleum – Gas University of Ploiesti, Romania. The software has been developed in close connection with the hardware architecture and it can be easily modified if the hardware is changed. At a larger scale, such a robot can be used to deliver parts, materials, products, books, medication etc. or for humans transfer. Areas of application include flexible manufacturing systems, oil refineries, libraries, hospitals as well as research applications. The only limit of the robot is that it moves along predefined paths which can be implemented in many ways: imbedded guide wires, paint strips, reflecting strips, light sensitive paths etc.

**Keywords:** software package, mobile robot, artificial neural networks, microcontroller.

## STUDY OF ELECTRO-DYNAMIC FORCES IN SHORT CIRCUIT REGIME USING MATLAB - SIMULINK SOFTWARE

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### ABSTRACT

Nowadays, computer simulation is more and more used in engineering applications. Powerful IT software helps researchers from all engineering branches to gain fast and accurate results. One of these tools is represented by the Matlab software package which is a powerful tool used worldwide in electrical engineering. The key features of Matlab are matrix-oriented programming, excellent plotting capability and the included graphical environment – Simulink – which highly simplifies the control scheme design. This paper focuses on the Matlab-Simulink software application for studying electro-dynamic forces. The single-phase short circuit and the three-phase short circuit are presented and for these situations the graphical correlation between these forces and time are presented for transitory phenomena. Simulation models and theoretical basement are presented also.

**Keywords:** electro-dynamic force, model, simulation, single-phase short circuit, three-phase short-circuit

## SUPPORT FOR SELECTED THERMOCHEMICAL CALCULATIONS IN THE FORM OF WEB SERVICE

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### ABSTRACT

Article is dedicated to creating and implementing a web service ThermoChemDC designed to address selected thermochemical calculations of chemical reactions for the purposes of process modeling in the acquisition and processing of raw materials. These calculations include the calculation of the heat capacity change, calculate the heat of reaction, calculate the change in entropy calculation of Gibbs free energy and calculate the logarithm of the equilibrium constant. Web service is the dominant representative of service-oriented architecture, which is briefly described in the introductory part of the contribution. The second part of the article deals with the characteristics of selected tools for supporting thermochemical calculations. The main part of article is devoted to the description of the ThermoChemDC web service itself, where are further specified the purpose of web service, basic mathematical relationships of selected thermochemical calculations, individual service functions and their parameters, output, and error XML structure of service. The web service is implemented as a class called ThermoChemDC in PHP5 development environment. The following section contains a description of error states of web service, followed by a brief description of algorithms of individual functions. The penultimate section is devoted to ways and means of using web service together with a specific illustration demonstration. In conclusion, the results obtained are summarized and outlined the way forward in addressing the issue.

**Keywords:** SOA, web service, thermochemical calculations, PHP

## SWITCHING ELECTRIC CIRCUITS WITH DC HYBRID BREAKER

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### ABSTRACT

The use of computer simulation has always been a powerful tool for technology in all its various fields of application. This paper describes a method and concept used to simulate the extinguishing of the electric arc occurring between the contacts of direct current breakers, using the Simulink toolbox within Matlab Software package. By the advanced use of the available software the electric arc extinguishing can be analysed easily and in detail. The method consists of using an LC type extinguishing group to be optimally sized. From this point of view is presented a theoretical approach to the phenomena that occurs immediately after disconnecting the load and the specific diagrams are drawn. Using these, the elements extinguishing group we can choose. At the end of the paper there is presented an analysis of the circuit switching process by decomposing the process in particular time sequences. For every time interval there was conceived a numerical simulation model in Matlab-Simulink medium which integrates the characteristic differential equation and plots the capacitor voltage variation diagram and the circuit dumping current diagram.

**Keywords:** diagram, electric arc, hybrid breaker, model, simulation

## TESTING AND AMENDMENT WEB SERVICE FOR THERMOCHEMICAL PROPERTIES IN RELATION TO THERMOCHEMICAL CALCULATION

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### ABSTRACT

The paper deals with testing of the web service ThermoChemDC intended for thermochemical calculations by means of a comparison of the results of this service with other sources. The service is based on the use of other web service TermPropService intended for thermochemical properties, which for its operation utilizes a comprehensive database infrastructure. The introduction contribution specifies the purpose and main features of both web services. It also characterizes main components and functions of database infrastructure and the reasons for amendment of communication between the preparatory and operational database. The second part is devoted to the comparison of the web service ThermoChemDC results with other resources in terms of calculations specific heat capacity, entropy, heat of reaction, Gibbs free energy and logarithm of the equilibrium constant. The next part is devoted to amendment of solution communication between the preparatory and operational data in the form of manual updating of data and data backup database to streamline the administration of the database infrastructure.

**Keywords:** web service, thermochemical properties and calculation, PHP, SOA

## THE ANALYSIS OF Al-Si ALLOY FLUIDITY TEST IN COMPUTER SIMULATION

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### ABSTRACT

The results of the fluidity test obtained by computer simulations (software NovaFlow&Solid) and by experiment were compared. Two types of the molds were used: a horizontal mold with 3 canals and a vertical mold with 6 risers. AlSi10MgMn (EN 1706) alloy was the experimental material, the casting temperatures ranged between 605°C and 830°C in ten levels. Measurement systems analysis (MSA), the analysis of the variance (ANOVA), t-test and the analysis of correlation were used for the evaluation. Values of fluidity for each temperature level obtained by the horizontal mold have a high degree of agreement with those obtained by casting process simulation. On the contrary, the values, obtained by the vertical mold are more sensitive to the operator. This fact caused the match between the simulation and a practical experiment is only partial.

**Keywords:** fluidity, test, Al-Si, computer simulation.

## THE STRUCTURAL DESIGN OF A MULTILINGUAL WEB APPLICATION

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### ABSTRACT

The contribution deals with the construction of a multilingual web application. Requirement of multilingualism of various web applications is currently very topical. The proposed procedure allows a simple and effective creation of multilingual applications also in the case of large and complex structures. In the introductory section the contribution characterizes different factors and aspects that affect the process of creating a multilingual website. The second section explains the principle solution that is modular concept of all parts of the application (the sites). The next section is devoted to the practices and implementation of the proposed solutions. The only parameter of application is a language code. This code is obtained in reference to the required language and sending to the current applications script. To illustrate the proposal was created short sample application that demonstrates principle of creating multilingual application using the example of the three languages (English, Slovak, and Czech).

**Keywords:** multilingual, website, HTML, PHP, modularity

## **THE USE OF CAX SYSTEMS AS A TOOL TO REDUCE THE ECONOMIC COSTS IN THE AVIATION INDUSTRY**

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**Assoc. Prof. Ján Piľa, PhD.**

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### **ABSTRACT**

Today is the trend of efficient production and meet customer needs. Nowadays it can be achieved only by introduction of computer-aided manufacturing. Example of this is the fact that companies are constantly changing their traditional production system to automatized and implementing new computer technologies. Because a firm's system of quality is mainly measured by customer satisfaction. The article refers to the need for the proper management of production activities at the company by the way of introduction of computer aided manufacturing. The main purpose of the article is to point out that the implementation of CAx systems is appropriate for the current market developments with the need of quality and competitiveness. The contribution also points to the need for proper management of production activities at the company. At the end of the article, authors describe the production process of dashboard sheet from the plane Viper SD-4 and its improvement in terms of cost savings for its production with the assistance of a CAD system.

**Keywords:** CAx system, design, manufacturing, metal, dashboard

## **THE USE OF THE SELF-SIMILARITY DISTRIBUTION AS A DIGITAL IMAGE FEATURE IN THE PROBLEM OF CLASSIFICATION**

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### **ABSTRACT**

The paper deals with the description of a self-similarity feature of a digital image. New image indications characterizing the internal distribution of self-similarity and the most similar image fragments are suggested here. The algorithm of image fractal indication shaping: characteristic image fragments and self-similarity distribution nature is described in the paper. The investigation findings of the self-similarity distribution applicability in the problems of image classification are given in this paper.

**Keywords:** digital images, fractal image processing, images features, image classification.

## THE USE OF VISUALIZATION IN AIRCRAFT DESIGN NODES BY USING CAX SYSTEMS

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### **ABSTRACT**

CAX systems are used in various industries and allow to accelerate and simplify engineering activities such as drawing, design, etc. There are many computer CAX systems, in this article that we are trying to utilize powerful software tools of working environment Assembly design, which provides us CAX system - CATIA V5. The purpose of the present article is to develop a generalized procedure with a reduced redundant step and establish a general scheme of the procedure to create a complete visualization of the selected node design of the aircraft from its individual construction elements. The reason for creating a 3D model of the node design of the aircraft was to simplify and make the experiments more effective for the Aviation Faculty of the Technical University and the laboratory of intelligent control systems for aircraft engines.

**Keywords:** CAX systems, visualization, design

**TRANSMISSION OF A PRESENTATION IN A TREE NETWORK TOPOLOGY****Mgr. Marek Menšík, Ph.D.****Ing. Martin Prokeš**VSB – Technical University of Ostrava, **Czech Republic****ABSTRACT**

Knowledge transfer to students or in general to a group of people is realized in many ways. The standard form is teacher's delivering lectures to the audience in the same room. This is a commonly used and effective style of presentation. If the students are interested in the topic, they can be directly involved in the presentation.

If a student cannot take part in the presentation, it is necessary to provide consultations or let the student study the topic themselves. Another modern method of lecturing is a remote presentation so that students can follow the lecturer in another room or even at home. With the help of current technologies listeners can use a computer, cell-phone or tablet-pc and simply follow the teacher on the screen of their device in real time. In the best way the record of lecturer's presentation is stored in a web repository so that the students can follow the talk offline as well.

In this paper we deal with the first option that is following the lecturer online. It is evident that online presentation is associated with quite a lot of problems concerning the form and mode of transmission of video and audio. The biggest weakness of such systems is the limited number of concurrent participants. This limitation is usually due to the server side, because the server fails to serve a larger number of clients. If the data transfer is realized by just one server, we are limited not only by the performance of the server, but also its transmission bandwidth. In order to make it possible that a larger number of students would share a video and audio, we must be able to spread the load among several nodes (servers) that are involved in the transfer. These servers are then connected in a tree network topology.

To this end an algorithm and protocol have been designed such that data transmission is realized in the above described way. In this paper we describe such a protocol and introduce the strategy of data transmission in a tree network topology. We will also deal with practical results that were obtained during full operation of the system.

**Keywords:** webinars, ForceB, FBP

## **USING INFORMATICS FOR THE STUDY OF COMPLEX NATURAL AND SOCIAL SYSTEMS**

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### **ABSTRACT**

It is sharing spread view on the nature of information as fundamental property of the matter. The rules and principles of mathematics, physics, cybernetics, quantum mechanics philosophy and informatics were applied to prove the information nature and bit as the unit for it measurement. It is proved that information expresses the ration and relation of matter, energy, movement, space and time (MEMST) in any complex natural or social phenomena. The differences between the meaning of the information for living things and that are for inorganic ones are analyzing.

**Keywords:** information nature, complex natural system, information content of atom, social system development

## UTILIZATION OF INTERNET OF THINGS AS INFORMATION SUPPORT FOR TECHNOLOGICAL PROCESS OF THE MINE

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### ABSTRACT

Both surface and underground mine consists of energy network (electricity, gas, water, etc.) systems. Furthermore, there are a number of sensors which ensure protection against dangerous concentrations of gases, high temperatures, oxygen deficiency, etc. Engineering networks are equipped with sensors of physical quantities. All these sensors can be connected through the Internet of things and communicate with each other. Data are processed and sent to the head mount displays of miner utilizing AR. Looking at the specific technology node or line element the system can visualize operating parameters and other information about it. We consider Internet of things to be the key technology of modern information systems. Communication based on ONS (object name services) allows you to search the required information sources and use them as data sources. A typical example might be the RFID technology with related communication standards. The essential components of the system using the aforementioned procedures are high quality data from technological networks of sensors and detectors. The data in the presented system are mediated and described using communication principles of the Internet of Things. The Internet of Things as the emerging technology has been playing an increasingly important role in communication of smart devices and MEMS which slowly find their way also into the mining environment.

**Keywords:** Mining, Smart sensors, Internet of Things

**VISUALIZATION OF THE REHABILITATION OF THE POST-MINING  
LANDSCAPE IN THE CZECH-POLISH BORDERLAND  
OF UPPER SILESIA – LOUKY AREA**

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**ABSTRACT**

The historic area of Upper Silesia straddles the border between the Czech Republic and Poland and features a high concentration of mining and metallurgical industry. Industrial activity has affected the landscape. The impact is often being eliminated through land reclamation and restoration. The article deals with areas lying at the boundary between the two states; the border is formed by the Olše (Olza) river. This area has been heavily affected by mining and features large subsidences. The most significant subsidence is found on the Czech side at the site of the former village of Louky. The article describes the procedures of reclamation, reclamation solutions, GIS models and 3D models. The article also explains the process of developing an information system, feeding the system with data, visualisation of the final solutions and designing of solution versions. The result is a visualisation model of the subsided areas at Louky, affected by the mining activity at the ČSM Mine.

**Keywords:** Landscape visualization, GIS, land reclamation, SPOLCZECH, Upper Silesia, landscape affected by mining

## MODELLING FOR BATCH SERVICE QUEUING SYSTEMS FROM THE POINT OF VIEW OF SYSTEM DYNAMICS

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### ABSTRACT

The paper focuses on the specific issues of modelling batch service queuing systems. It deals with traditional methods of simulation by Petri networks, as well as options offered by utilizing the Powersim Studio that belongs to the SW group for dynamic modelling. If the mathematics of batch service queuing systems is integrated into the system dynamics rules, the final model functionality increases considerably, providing for application in many fields of practice. The paper also takes into account the issues of optimum service provisions as regards customers of retail trade networks.

**Keywords:** queuing system, dynamic modelling, batch service, Petri networks.