ARMED FORCES ACADEMY OF GENERAL MILAN RASTISLAV ŠTEFÁNIK

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ABSTRACTS

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The Armed Forces Academy of General Milan Rastislav Štefánik is the non-faculty structured state military higher educational institution. The Academy is situated in Liptovský Mikuláš, Slovak Republic. The Academy has an international acceptance and its main mission is to educate, improve skills and train students in higher and lifelong career education. Its mission is to develop good personality, knowledge, creativity and motivation in students to prepare them to serve their country and to be effective within national and international environment.

In addition to education and training, the Armed Forces Academy focuses on development of science and research to support security and defence of the state and development of capabilities within the Armed Forces of the Slovak Republic. The Academy participates in project solution of basic and applied research, in international research projects as well as in scientific and professional committees. The research results are implemented into teaching process and thus the Academy has become a unique base that enhances the quality of personnel training for the Armed Forces of the Slovak Republic and for the state security community.

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ARMED FORCES ACADEMY OF GENERAL MILAN RASTISLAV ŠTEFÁNIK
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PhDr. Jana VITOVSKÁ

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SECTION
MECHANICAL ENGINEERING

CHANGE OF MATERIAL DURING THE PRODUCTION OF THE ALLIGATOR 4X4 VEHICLE

Rastislav BALCIAR

Consultant: Maj. Dipl. Eng. Vladimír Kadlub

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The material of the bodies of the Alligator 4x4 vehicle is changed during production. The new material has a better ballistic protection than the one used earlier. This was necessary because of changing combat conditions in Afghanistan, where armor-piercing 7.62mm bullets are increasingly being fired from long distance at soldiers and vehicles alike. In addition to that, there is an increasing use of hand grenades with delay fuses against troops and armored vehicles as well as improvised explosive devices (IEDs) buried under roads or hidden in asphalt road surfaces making them very hard to detect by existing mine detection systems like metal detectors or ground penetrating radar (GPR).
During 2007-2011 ISAF decided to improve on some parts of their BMP-2 Infantry Fighting Vehicles which were fielded in large numbers for many years without major upgrades due mainly to lack financial resources for such programs: Improving BMP-2 Fire Control System, Improving BMP-2 Kontakt ERA Armor Protection, Upgrading Engine Power & Reliability. I have already written about these improvements here and here .
New improved armament package consisting of PKT machine gun mounted over the 100mm main gun:
Another improvement introduced gradually since 2009 was replacing all old age 7.62mm PKM machine guns on top roof hatches with new generation Russian made 2A42 30mm autocannons capable also firing highly effective high explosive rounds, see below picture taken during testing at NII Stali proving grounds near Tula, Russia back in September 2011.

Keywords: Aligator, 4x4, material, non-metalic, stabilizer bar

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ANALYSIS OF TATRA 815 8X8 VEHICLES

Natália ČEPELOVÁ

Consultant: Prof. Dipl. Eng. Peter Droppa, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The aim of this work is to compare the construction, external characteristics of engines, engine power when driving uphill, traction characteristics, dynamic factor, and braking distance of the TATRA 815 VVN 26 265 8x8.1R (hereafter referred to as TATRA 815.1R) and TATRA 815-7 VVN 8X8 (hereafter referred to as TATRA 815-7). The first part of the work focuses on the general characteristics of the selected vehicles and some of their basic parameters related to off-road performance. The next part presents the mathematical formulas used to calculate the values of the studied parameters such as performance , dynamic characteristics, and braking distance on different surfaces given adhesion coefficients. The third and final part of the work is to compare the individual calculation tables and graphs in order to evaluate the improvement or deterioration of the analyzed parameters.

Keywords: TATRA, engine power, traction characteristics, vehicle dynamics, braking distance, OS SR

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TEST STAND OF TURBINE ENGINE POWERED BY E-FUELS

Marcin DOPIERALSKI

Consultant: Marcin Dopieralski

Military University of Technology, Warsaw, Poland

Abstract: The paper deals with research turbine engine and use it to carry out simulations of the combustion process using ANSYS software.. Over the past decade or so, significant efforts have been made in the industry, government and academic communities to understand the unique problems associated with combustion problems in low-emission gas turbines. The purpose of this work is to develop a combustion chamber model for a research turbine engine and to conduct simulation studies of working fluid flow through the inlet ducts with analysis of the results. This work includes a description of the analysis of the construction, operation of gas turbines along with their use in hybrid systems, as a primary source of energy. It goes on to discuss the basic processes of combustion different fuels in the combustion chamber such as e-fuels, the phenomena occurring in this process and the simulation tools used in CFD (numerical methods for solving fluid flow issues).

Keywords: turbine, engines, combustion, analysis, fluid flow

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ANALYSIS OF MILITARY WHEELED EQUIPMENT IN CAD SOFTWARE

Samuel DUBJAK

Consultant: Dipl. Eng. Miroslava Cúttová, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: In the work, we will focus on the military wheeled equipment of the Armed Forces of the Slovak Republic. We chose the Tatra 815-7 vehicle, also known as Tatra force.
The first part will mainly concern the construction of the chassis and its partial analysis of the frame, axles and wheel reductions. We will also deal with the transmission mechanism of the vehicle with individual possible variations of power units and mechanical transmissions.
In the next part, the strength analysis of the gears of the wheel reduction planetary gear will be performed.
Subsequently, an analysis is performed in CAD software with a simulation of the modeled part of the chassis. In the selected Solidworks CAD software, we will model the wheel reduction together with other parts. The construction of the wheel reduction is based on the planetary gear.

Keywords: Tatra, Tatra force, planetary gear, wheel reduction, wheeled equipment

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ANALYSIS OF THE USE OF INFANTRY FIGHTING VEHICLES

Marek FERENČÁK

Consultant: Prof. Dipl. Eng. Peter Droppa, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: This work is focused on creating an analysis of current infantry fighting vehicles. An infantry fighting vehicle (IFV) is a type of armoured tracked vehicle used to transport mechanized units into battle and provide direct fire support for these units. The analysis will be performed by comparing selected parameters, in terms of the basic requirements for an armoured tracked vehicle - mobility, firepower and protection. The result of the comparison will be radar graphs, based on which we will determine the overall ranking. In the second part of the work, we will evaluate the propulsion system of the current IFV of the Armed Forces of the Slovak Republic - BMP 2. The evaluation will be performed by analytical and simulation approach. In the analytical part, we will create traction characteristic. The simulation propulsion will be evaluated using a model created in the programming environment MATLAB/Simulink.

Keywords: infantry fighting vehicle, analysis, radar graph, simulation, model, Simulink

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SPECTROMETRY AND SPECTROMETERS

Sebastián FOJTÍK

Consultant: Dipl. Eng. Eva Popardovská, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: Spectroscopy is the study of the interaction between light and matter, and it is used to analyze and identify the properties of materials based on their interaction with electromagnetic radiation. Spectrometers, which are instruments used in spectroscopy, measure the intensity of light as a function of wavelength or frequency. They are widely used in scientific research, analytical chemistry, materials science, pharmaceuticals, and many other fields to identify and characterize the composition of substances. Spectrometers operate based on the principles of absorption, emission, or scattering of light by molecules or atoms in a sample, which can provide information about the sample's chemical composition, molecular structure, and physical properties. They typically consist of a light source, a sample holder or cuvette, a wavelength or frequency selector, and a detector to measure the intensity of light after it interacts with the sample. Different types of spectrometers include UV-Vis spectrometers for ultraviolet and visible light, IR spectrometers for infrared light, and mass spectrometers for analyzing the mass-to-charge ratio of ions.

Keywords: Spectroscopy, spectrometers, molecules, atoms, light

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VARIANTS OF ORGANIZATIONAL STRUCTURES OF FORCES AND RESOURCES OF TECHNICAL SUPPORT

Ján FOLTIN

Consultant: Maj. Dipl. Eng. Vladimír Kadlub

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The aim of the work is to process the proposal of variants of organizational structures of forces and resources of technical support of the tactical level of the armed forces of the Slovak Republic in graphic and tabular form. The result of the work will be an aid - an overview diagram of the organizational structures of the military units selected by us. The scheme will be created with valid NATO markings. We have chosen 3 units whose tasks are to fulfill the tasks of technical and logistical support for the needs of the armed forces of the Slovak Republic. 20th Logistics Battalion Prešov, 405th Repair Battalion Martin and 53rd Field Services Battalion Hlohovec. In the work, we will summarize the basic goals, tasks and importance of logistical support and technical support in the Slovak Armed Forces. We will also discuss the issue of the number of forces and technical resources for the provision of technical security.

Keywords: organizational structures, forces and resources, technical support

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OPTIONS AND RESTRICTIONS OF ELECTRIC PROPULSION OF SMALL UNMANED GROUND VEHICLE

Adam FULEK

Consultant: Assoc. Prof. Dipl. Eng. Vladimír Popardovský, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The main goal of this work is to find use of electric propulsion used in small ground vehicles, characterize their restrictions and options and potentionaly a way how to use them in military background. Also the main parts of electric propulsion is an electric engine with some form of stored energy from acumulator bateries, which will be desribed. Then in this work we took some measurements of our unmanned ground vehicle, to find out its main parameters such as gear ratio maximum speed which our vehicle is capable of achieving. This information was very important for our later experiments. Also we described principles of controls of this vehicle and a way how we measured given parameters. Also we worked with 3D printer as a way to help us consolidate speed sensor. Then from measured parameters we created Matlab model in Simulink, and found out options and restrictions of our vehicle which can be aplied to almost every electric vehicle.

Keywords: electric propulsion, restriction, option, acumulator, electric engine

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SIGNIFICANCE OF TECHNICAL ENDOSCOPY IN DEFECTOSCOPY OF MOTOR VEHICLES

Krištof GLOGOVSKÝ

Consultant: Cpt. Dipl. Eng. Pavol Lukášik, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The aim of our work is to introduce endoscopic methods and their use in the field of diagnostics of motor vehicle faults. At the beginning of the work, the history of the development of diagnostics using endoscopic means is included. In the theoretical part, we have described in detail every endoscopic device that is currently in use. The description of individual equipment consists of its basic description, principle of operation and its usual working environments. In the practical part, we dealt with the real use of the endoscopic camera. We tried to solve the problems using an endoscopic camera. We have described the individual disorders in detail, from the initial symptoms to the diagnosis using an endoscopic camera to the evaluation. We performed these diagnostic measurements on customer vehicles in service. In conclusion, we evaluated the importance of endoscopic cameras in the operation of services.

Keywords: technical endoscopy, diagnostics, non-destructive diagnostics, borescope, fiberscope, videoscope

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PROPOSAL OF A TRAINING SYSTEM FOR AN FPV UAV COMBAT DRONE WITH AN ELECTRO-DUCTED FAN PROPULSION

Emma HUNKOVÁ

Consultant: Assoc. Prof. Dipl. Eng. Vladimimír Popardovský, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: Subject of my contribution is proposal of training system of UAV combat drone. Propulsion of this drone is supposed to be Electric Ducted Fan unit (EDF). Because EDF uses high rpm electromotor, there is important to use EDF with balanced rotor. For EDF dominant source of vibrations is uneven distribution of the rotor mass with respect to its axis of rotation. For this reason, it is necessary to balance the rotor - statically and dynamically. Therefore, the next goal of my work is vibration analysing of an experimental EDF, its static and dynamic balancing and comparing with the another EDF - the same category but factory balanced. For my measuring I used vibrodiagnostic unit PULSE from Brual & Kjaer manufacturer and MATLAB/Simulink software was used for data processing.

Keywords: Electric Ducted Fan (EDF), Unmanned aerial vehicle (UAV), vibrations, static balancing, dynamic balancing, Fourier transform

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THE EFFECT OF CHANGING THE TEMPERATURE OF THE VACUUM HARDENING PROCESS ON THE PROPERTIES OF THE LAYER

Martin KLIMEŠ

University of Defence, Brno, Czech Republic

Abstract: Gears and shafts are critical components that play significant role in the automotive industry. During the manufacturing of precision gear and shafts, various heat treatment steps are required to achieve the desired dimensions, surface hardness, and core toughness of the part. This article is focused on the evaluation of the effect of the temperature of the vacuum hardening process for chosen steel that is widely used for the production of automotive components. The vacuum hardening process was carried out in the ALD ModulTherm device, when the effect of temperature and time changes on selected properties of the case-hardened layer was evaluated. Basic parameters such as austenitic grain size, microstructure, and profile of the case-hardened layer were evaluated. The results of the experiments showed that the temperature has a significant effect on the surface properties, the microhardness and the depth of the carburized layer changed significantly.

Keywords: vacuum cementation, chemical composition, microstructure, hardness, cemented layer

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ANALYSIS OF THE COMBAT USE OF TANKS

Tomáš KRIŠ

Consultant: Prof. Dipl. Eng. Peter Droppa, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The aim of my work was to analyze the combat use of tanks. In the first part of the work, I will focus on the technical parameters of selected tanks. Subsequently, these parameters will be compared, with each parameter having its own weight. Based on the point rating, a ranking will be created with an evaluation. Radar charts will be created for graphical representation of the compared parameters. In the second part of the work, we will focus on calculating the dynamic properties of the T-72 M1 tank. We will create and describe the traction characteristics. In the last part of the work, we will create a simplified model of the tank's propulsion mechanism in the MATlab-Simulink. The model consists of an engine and a gearbox, which, after analysis, will be set to real values. The simulation also focuses on shifting the individual gears. The output from the simulation will be various graphs, especially the traction characteristic.

Keywords: tanks comparison, MATLAB, simulink, planetary gearbox, engine

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ANALYSIS OF THE CRANK MECHANISM OF THE UTD 20 ENGINE

Ján LYSÝ

Consultant: Dipl. Eng. Miroslava Cúttová, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The design of the engine is very important with regard to its reliability and durability. The most important and at the same time the most stressed part is the crank mechanism. The aim of my thesis was to describe the design of the crank mechanism of the UTD 20 engine, which is used in infantry fighting vehicles (IFVs). In the first step of this thesis, I described the infantry fighting vehicle and its use. Later, I discussed the actual design of the crank mechanism of that type of engine and the creation of 3D models of the various important parts of the crank mechanism. The conclusion of the work is a functional assembly of the crank mechanism, which can be used for educational purposes.

Keywords: crank mechanism, engine, assembly

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REFRACTOMETRIC ANALYSIS OF OPERATING SUBSTANCES OF MOTOR VEHICLES

Boris MATTA

Consultant: Cpt. Dipl. Eng. Pavol Lukášik, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: This bachelor thesis has been prepared with the intention of providing basic information on coolants and windscreen washer fluids based on refractometric analysis. While analyzing the individual fluids, I observed their efficiency, ecology, price and by refractometric analysis I assessed the deviation between the measured freezing point value of the fluid versus the declared value stated by the manufacturer. Based on this, the refractometric methods, the most basic types of refractometers and the history of refractometry are described in this thesis. For easier understanding of refractometry and refractometric instruments, the thesis includes a description of the basic properties of light.

Keywords: refractometer, refractometry, windshield washer fluids, coolants, light

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DEVELOPMENT OF REPAIR CAPABILITIES WITHIN MOBILE WORKSHOP EQUIPMENT

Miloš MIHALÍK

Consultant: Maj. Dipl. Eng. Vladimír Kadlub

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The aim of this work is to acquaint the reader about options of improving the mobile workshops that are used in Slovak Armed Forces. In this work, we point out to development of mobile workshop facilities and, consequently, to their current form, concretely container workshop of the DIELKON type. Within the DIELKON type of container workshop facilities, we point out the current technical equipment and repair capabilities of individual container workshops, as well as the vehicles, guns and other technical equipage that can be repaired using this repair equipment. In the last part, we point out the need of renewing and change of repair equipment due the introduction of modern equipage and vehicles into Slovak Armed Forces, with which the repair equipment is not currently compatible and therefore these modern equipage and vehicles cannot be repaired by using it.

Keywords: mobile workshop, DIELKON, container workshop, repair capabilities, repair equipment

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SENSORS OF EXHAUST EMISSIONS OF COMBUSTION ENGINES AND THEIR TECHNICAL DIAGNOSTICS

Adam PIRHALA

Consultant: Cpt. Dipl. Eng. Pavol Lukášik, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The subject of the bachelor's thesis is to inform the reader about harmful substances created by the burning of organic fuels and the measurement of exhaust gas sensors in internal combustion engines, whether petrol or diesel.
In the beginning, we will imagine what substances are created by burning fuel in internal combustion engines. Their gradual reduction in the territory of the European Union using EURO standards. Let's take a closer look at individual harmful substances for people, nature and the atmosphere. Characteristic features of these undesirable gases and their impact on the environment. In the second part of the work, we will present the sensors that affect the exhaust gases in petrol and diesel engines by reducing the fuel mixture based on the signal from the lambda probe delivered to the control unit. In the final part, we will select a pair of lambda probes for diagnostic measurement and imagine possible malfunctions and their occurrence.

Keywords: exhaust system, emissions, emission standards, lambda probes, diagnostics, exhaust gases

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METHODS OF CREATING COATINGS ON METAL AND NON-METAL SURFACES

Tomáš ŠPÁNIK

Consultant: Dipl. Eng. Eva Popardovská, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Mechanical Engineering, Liptovský Mikuláš

Abstract: The goal of my work was to develop and evaluate the issue of creating coatings on metallic and non-metallic surfaces. In the first part, I will discuss the important properties of metal and ceramic materials. I will describe what are the main differences between ceramic and metal material and its use. I will mention the impurities that are on the surfaces and must be removed, the so-called pretreatment, which is very important for perfect application and creation of a complete, intact surface. In the last part, I will describe what are the mechanical and chemical-physical forms of pretreatment that need to be performed for the given material. I will focus mostly on blasting, which belongs to the form of mechanical pretreatment of the surface, because it is one of the most used forms of surface treatment. In conclusion, I will state the shape of the blasting means and their properties.

Keywords: impurities, pretreatment of the surface, formation of coatings, metallic materials, ceramic materials

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DESIGN OF THE CONCEPT OF UNMANNED COMBAT GROUND VEHICLE

Miroslav TOMAŠTÍK

Consultant: Prof. Dipl. Eng. Peter Droppa, PhD;
Assoc. Prof. Dipl. Eng. Vladimír Popardovský, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department Mechanical Engineering, Liptovský Mikuláíš

Abstract: The first part of the work deals with the general distribution of unmanned ground vehicles (UGV - unmanned ground vehicle). In this section it is also possible to find the basic requirements imposed on UGV. The second chapter deals only with medium heavy UGVs. The result of this part is the basic expected dimensional parameters of the proposed vehicle. The design of the vehicle will then be based on these parameters. After determining the basic dimensions, we proposed the type of drive. We determined the drive mechanism for the given type of vehicle to be a serial hybrid drive. In the third chapter, we determined the maximum vehicle speed that the vehicle must reach under certain conditions. From these conditions, we determined the necessary performance to meet the given conditions. After choosing the electric motor, we thought about choosing the transmission mechanism. We have created two variants of the transmission mechanism. The last chapter is devoted to the chassis part of the vehicle. In this part, we tried to simulate the passive suspension of the vehicle. We created the simulation in the Matlab - simulink program. After creating the simulation, we set the optimal suspension parameters in the simulation plane.

Keywords: UGV, unmanned ground vehicle, design, model, simulation

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SECTION: INFORMATICS I. – SYSTEMS AND APPLICATIONS

ANOMALY DETECTION USING ARTIFICIAL INTELLIGENCE METHODS

Bianca BADIDOVÁ

Consultant: LtCol Assoc. Prof. Dipl. Eng. Michal Turčaník, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The purpose of this paper is to investigate the latest developments in the field of anomaly detection. Our particular focus was on detecting malicious attacks within network flows. We have examined the use of unsupervised approach on Long Short-Term Memory and Gated Recurrent Unit neural networks. Those networks are known for their ability to identify anomalies within complex datasets. We conducted data analysis and preprocessing of chosen datasets, which was a crucial part of this study. To evaluate the effectiveness of our proposed topologies, we trained them using benign communication data and then tested their performance on a dataset containing both malicious and benign communication data. Our comparative analysis focuses on evaluating the performance of proposed topologies and their solution complexity, which can provide valuable insights for enhancing anomaly detection systems.

Keywords: artificial intelligence, anomaly detection, recurrent neural networks, gated recurrent unit, long short-term memory neural networks

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LANGUAGE PROCESSOR GENERATORS (COMPARATIVE STUDY)

Marek BALÁŽ

Consultant: Assoc. Prof. RNDr. Ľubomír Dedera, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of this thesis is to compare the syntactic structures and individual properties that can influence the program design of specific language generators such as Flex and Bison, JavaCC and Antlr using the proposed example. The thesis informs about the basic theoretical knowledge and principles that are necessary to become familiar with language processors. It then discusses the actual issues of language processors such as their internal structure subdivision into certain categories and their basic functionality. In the next section, we will look at the description of individual language processor generators. We will explain how they work, how they process input values and what types of grammars they can work with. Finally, we discuss the implementation of the proposed language which in our case is a simplified model of the language that serves the Cisco router devices into the individual language processor generators and compare their syntactic structures.

Keywords: Language processor generators, language processor, grammar, Bison, Flex, JavaCC, Antlr

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NATURAL LANGUAGE PROCESSING IN PYTHON

Adam BENDŽALA

Consultant: Assoc. Prof. RNDr. Ľubomír Dedera, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of the thesis is to create a study aimed at explaining key concepts and analyzing existing software solutions in the field of Natural Language Processing in Python. The thesis reports on the basic theoretical concepts that are necessary for subsequent understanding of the subject, with emphasis on applications and areas of use of Natural Language Processing. Subsequently, the thesis discusses the analysis and comparison of existing software tools for Natural Language Processing in Python programming language based on the area of application, performance, ease of use and availability of documentation and educational materials. Finally, the thesis discusses the applicability and possible implementation of Natural Language Processing in the field of the armed forces.

Keywords: natural language processing, Python, software tools, analysis, natural language toolkit

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A SURVEY OF DEEP NEURAL NETWORKS IN MATLAB

Karolína DEVEČKA ŠKOP

Consultant: Dipl. Eng. Radoslav Forgáč, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of this work is to elaborate a survey of available Deep Neural Network models and a detailed study of selected deep neural network models, including examples of their learning and testing in Matlab environment. The main contribution of the thesis is considered to be a detailed procedure for solving selected practical examples focused on data classification in the form of case studies. The examples were designed to implement three deep neural networks, namely Convolutional Neural Network (CNN), Fully Connected Neural Network (FCNN) and Long Short Term Memory (LSTM). The case studies consist of all the necessary steps from specifying to testing the classification model, including the description of the datasets. The result of the work is a step-by-step manual explaining the principles of building classification models using selected neural networks in the Matlab environment.

Keywords: Deep Neural Network, Deep Learning, MATLAB, Convolutional Neural Network, Fully Connected Neural Network, Long

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OPTICAL TEXT RECOGNITION IN IMAGES USING PHP

Terézia JANÍKOVÁ

Consultant: Maj. Dipl. Eng. Boris Matej

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The competition submission focuses on creating and implementing a PHP plug-in into the web application. The aim of the work is to familiarize the reader with optical character recognition and creating a PHP plug-in. The second chapter focuses on available open-source and paid tools, libraries, and applications used for text recognition from images. In the third chapter, we focus on the design and creation of our plug-in for optical character recognition and its implementation. We have analyzed the available options for creating the plug-in. The basic design step involves image processing, which we carry out in the programming language Python. The second step is the delineation of the area on the image where the vehicle registration number is located. The third step is recognition, which we will implement in the programming language PHP using a hashing function. The final step is the implementation of the PHP plug-in into the application.

Keywords: PHP, Python, OpenCV, optical image processing, optical character recognition

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DETECTION OF OBJECTS IN IMAGES USING MATLAB

Adrian KLEFFLER

Consultant: Dipl. Eng. Martin Javurek, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: This thesis deals with the issue of object detection in digital images and compares different tools for object detection in the MATLAB environment. An overview of tools for object detection in images is presented and compared on a specified image database. The experimental results are evaluated, and a manual is created, describing each tool for object detection in images. The knowledge gained from testing the individual tools for object detection in MATLAB is evaluated and practical advice is provided for using these tools. This work provides valuable insights into the effectiveness of different tools for object detection in images and is useful for developing new applications and technologies in this field. The results of this thesis can be applied in areas such as computer vision, autonomous systems, robotics and security systems.

Keywords: Matlab, object detection, image processing, neural network, computer vision, learning, vision, deep learning, machine learning

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PERFORMANCE COMPARISON OF JAVA, .NET, PYTHON, AND MATLAB PLATFORMS

Adam KLEPSATEL

Consultant: Assoc. Prof. RNDr. Ľubomír Dedera, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: This paperwork deals with the performance comparison of development environments for the Java, .NET, MATLAB, and Python languages. Various aspects of these environments were compared, including program execution speed, memory usage, and efficiency in processing large data files. The results show that each environment has its advantages and disadvantages, and there is generally no "best" development environment for all use cases. The conclusions of this work can be useful for developers in selecting the most suitable environment for their specific projects.

Keywords: comparison, Java, .NET, Python, MatLab

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DISPLAYING INFORMATION USING LED MATRIX VISUALIZATION

Kristína KYBOVÁ

Consultant: Dipl. Eng. Martin Javurek, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The main goal of the Students´ Scientific Conference was to build a functional LED MATRIX Visualization. In the practical part, we looked deeper into the hardware and creating an application to control the LED MATRIX visualization. We made a functional LED panel for displaying information. Based on the first part of the Students´ Scientific Conference, we selected the most appropriate methods, criteria and components for the assembling of the product. Next, we focused on the software and thus code generation in Visual Studio Code and Arduino environment, in which we created a functional web application PIXEL EDITOR. This web application works on a web server which runs on NODEMCU V3 in Arduino code, which is used for communication and control of the individual LEDs of the LED panel. The result of the Students´ Scientific Conference can also find use in the military sector for the visualization of military signs and symbols when danger occurs or during military operations. PIXEL EDITOR running on a web server allows the user to create or select an already saved custom design for displaying information in the form of a pictogram. The conclusion of the whole Students´ Scientific Conference is a functional web server and a LED panel for displaying information.

Keywords: LED, LED MATRIX, LED PANEL, PIXEL EDITOR, visualization, web server, displaying information

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AN OVERVIEW STUDY OF MACHINE LEARNING METHODS IN MATLAB

Michal ŠKODA

Consultant: Dipl. Eng. Radoslav Forgáč, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of this thesis is the processing of selected Machine Learning (ML) methods in Matlab environment, focusing on data clustering. The main contribution of the thesis is the development of a detailed procedure for solving selected practical examples of data clustering in the form of case studies. Those interested in the subject will be able to learn the basics of machine learning based clustering in Matlab environment in individual steps. The k-means method, followed by Agglomerative Hierarchical Clustering (AHC) and Density Based Spatial Clustering of Applications with Noise (DBSCAN) methods are discussed in detail. In case studies, all necessary steps from the assignment to the testing of the selected clustering method, including the description of datasets, are elaborated in detail. After studying the manual, the interested reader should be familiar with the basics of machine learning-based data clustering, as well as visualization and interpretation of results.

Keywords: clustering, machine learning, k-means, hierarchical clustering, DBSCAN, MATLAB

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SECTION: INFORMATICS II. – NETWORK DEVICES AND COMMUNICATION

SYSTEM FOR DETECTING MALWARE OPERATION ON WINDOWS ENDPOINT

Michal ČERVENÝ

Consultant: Maj. Dipl. Eng. Tomáš Šlajs

University of Defence, Brno, Czech Republic

Abstract: Ransomware is a type of malware that can cause significant damage to Windows endpoints, encrypting important files and demanding payment for their release. Traditional ransomware detection techniques, such as signature-based detection can be effective but are limited in their ability to detect new or modified ransomware variants. In this paper, we present a heuristic-based approach to ransomware detection on Windows endpoints. We focus on heuristic methods to create adaptable solution without the need for extensive long-term support. We also develop a functional demonstrator to showcase the effectiveness of our approach. The demonstrator should be lightweight, effective with low false-positive rate, and should be easy install and to manage. Also, we compare effectiveness of different approaches, and try to improve upon them to get better know-how for future development.

Keywords: malware, windows, functional demonstrator, detection on Windows endpoints

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ANALYSIS OF CYBER RISK

Stanislav DEVEČKA

Consultant: Prof. Dipl. Eng. Marcel Harakaľ, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of this work is to map the state and perform an analysis of qualified cyber risk assessment. The paper introduces the Cybersecurity Act 69/2018, which sets requirements for the prevention, detection, and elimination of cyber risks. We deal with the phases of cyber risk assessment, which include evaluation, consolidation, grouping, and are necessary for successful assessment and treatment of cyber risks that may pose serious threats to information systems security. We examine in detail the treatment of cyber risks using technical and non-technical means, their monitoring and assessment. The output of the work is recommendations for the treatment of cyber risks in the Armed Forces of the Slovak Republic, taking into account the effectiveness of the costs incurred for these measures.

Keywords: cyber risk, consolidation, grouping, treatment, Cybersecurity Act 69/2018, security, measures

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ANONYMISING DATA IN COMPUTER AND SOCIAL NETWORKS

Matej DULENČIN

Consultant: Assoc. Prof. Dipl. Eng. Július Baráth, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics
Liptovský Mikuláš

Abstract: The main goal of our work was to propose and practically verify the possibilities of anonymizing various forms of communication in computer and social networks. In the first part of our work, we performed an analysis of the available tools and techniques for anonymizing communication. In the next step, we verified these selected methods on given activities using a test environment. In this part, we focused on the possibilities and practical examples of anonymizing communication through web browsers, electronic mail, search and payment services. Next, we discussed the possibilities and practical examples of anonymizing communication through social services, including connections to them, and examples of anonymizing intercepted network communication. As a result of our work, we developed a recommendation for use in an AOS department environment.

Keywords: Anonymity, privacy, computer networks, social networks, TOR

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GENERATING USER ACTIVITY FOR FORENSIC ANALYSIS

Peter FEDÁK

Consultant: Assoc. Prof. Dipl. Eng. Miloš Očkay , PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: The aim of this work is to generate user activity for forensic analysis of the activities generated by us. The introduction of this work provides a general overview of what forensic analysis is. We will then examine the selection of activities that were chosen by us for the generation of user activity and the tools chosen. To generate the activity, we chose the PowerShell program in which we created scripts that simulated the common activities of a user. The created groups of scripts were subsequently launched in the MS Windows operating system in the virtualization environment of the Oracle VM VirtualBox tool. In this work, we will describe the principles and functionality of the scripts and draw conclusions.

Keywords: generate, Powershell, script, user activity, forensic analysis

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ATTACKS ON ELECTRONIC BANKING

Peter KONEVAL

Consultant: Prof. Dipl. Eng. Marcel Harakaľ, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics, Liptovský Mikuláš

Abstract: As the use of e-banking increases, so do the number of attacks that aim to steal sensitive financial data. This research work focuses on a detailed analysis of the existing types of attacks, with an emphasis on social engineering methods, specifically vishing and trashing. Vishing is a form of attack that gains the trust of a potential victim and then requests sensitive information from them, such as passwords or credit card numbers. On the other hand, trashing focuses on obtaining information from trash that may contain sensitive data. The research paper further discusses the design of measures to eliminate these methods of attacks. These measures include improving the security of banking websites, training bank employees and customers on cyber security, and using technical measures such as two-factor authentication. The aim of this work is to raise awareness of the risks of attacks on e-banking and to show how important it is to secure e-banking against these threats. In view of the ever-increasing number of e-banking users, it is essential that banking systems and their users are protected from these threats.

Keywords: attacks on electronic banking, secure threats, social engineering

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PERSON IDENTIFICATION USING THE RASPBERRY PI PLATFORM

Kamil LELÁK

Consultant: Dipl. Eng. Miroslav Ďulík, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Informatics
Liptovský Mikuláš

Abstract: This abstract focuses on the use of Raspberry Pi for person identification. Raspberry Pi is a small and inexpensive computer that provides enough processing power to solve various tasks. The use of Raspberry Pi for person identification is therefore very interesting because it can be implemented in places where resources are limited. Person identification can be achieved using various methods, including face recognition, fingerprint scanning, and voice identification. In this work, we focus on face recognition using a camera and Raspberry Pi. We will use the OpenCV library for face detection and feature extraction. These features will be stored in a database for each person to be identified. When someone tries to pass the camera, their features will be compared to the stored features in the database, and if a match is found, the person will be identified. This project could be used in various applications, such as access control systems, attendance tracking systems, or security systems. Additionally, thanks to the use of Raspberry Pi, this project could be implemented with minimal hardware and maintenance costs.

Keywords: Raspberry Pi, identification, face recognition, OpenCV, camera

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CREATING A SMART MIRROR USING RASPBERRY PI

Michaela OVČARIKOVÁ

Consultant: Dipl. Eng. Miroslav Ďulík, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department Informatics, Liptovský Mikuláš

Abstract: The aim of this students‘ scientific thesis is to design, configure and construct a smart mirror. The solution is based on the Raspberry Pi platform. Basic concepts are characterized in the theoretical part. The first chapter is devoted to the description of the hardware. The second chapter describes in detail the software that was used to implement this mirror. Furthermore, in the third chapter, the MagicMirror software is characterized together with the modules that were used to implement the assignment. The following chapters are devoted to the description of working with the Raspberry Pi from the first startup of the device to the implementation of MagicMirror and the configuration of its modules. These modules include a weather display module that pulls data from online sources in real time. Mirror's add-on is a calendar widget that syncs with your own iCloud calendar. In the resulting solution, which also includes other modules, they will be more comprehensively described in the thesis. The Bash scripting language and the Python programming language were used to configure the modules, in which a script was written to automatically turn off the monitor in the event that there is no movement in its vicinity for a longer period of time, using a motion PIR sensor.

Keywords: Raspberry PI, smart mirror, MagicMirror, Linux, PIR sensor

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CYBER THREATS AND THEIR PERSPECTIVE

Marián VALKUČÁK

Consultant: Dipl. Eng. Miroslav Ďulík, PhD.

Armed Forces Academy of General Milana Rastislava Štefánika, Department of Informatics, Liptovský Mikuláš

Abstract: The main goal of this work is to analyze cyber threats and their future impact on security. The first part of this work shows an overview of current threats and analyzes how current threads could lead to potential future threats. The second part covers security risks and threats which were created as an impact of new products and platforms being developed. In the final part of this thesis analyzing cyber threats that could take a huge impact in the near future. With the development of new technologies, new threats will also arise, which will need to be addressed through prevention and various methods of risk reduction.

Keywords: OWASP, cyber threats, cyber security, INFOSEC, malware, web application security

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SECTION: ELECTRONICS

MODELING OF ANTENNAS FOR DISTANCE LABORATORY EXERCISES

Viktória ČORBOVÁ

Consultant: Assoc. Prof. Dipl. Eng. Zdeněk Matoušek, PhD.

Armed Forces Academy of General Milana Rastislava Štefánika, Department of Electronics, Liptovský Mikuláš

Abstract: The presented work for the Student Scientific Conference (ŠVK) deals with the design and creation of laboratory exercises for the course of Antennas and Wave Propagation for distance learning. Individual laboratory measurements are carried out in the MATLAB - Simulink software environment, with the prerequisite for their mastery being that the cadet knows the basic theory of antenna radiation, their parameters, and technical characteristics.
The work is divided into two parts. The first part describes the methods of measuring selected types of antenna parameters, supplemented by measurement circuit diagrams. In the second part of the work, measurement workplaces for selected types of antenna parameters for distance learning are designed and implemented in the MATLAB - Simulink software environment. These workplaces are implemented through four different procedures, which are described in the introduction to the second part.
The results of the work at the ŠVK are presented in the form of sample measurements of selected types of antenna parameters, which are included in the annexes of the work. As mentioned, the work is intended as a guide for students studying by distance learning. Its goal is to bring cadets as close as possible to the processes and procedures involved in real measurements of antenna parameters carried out within laboratory exercises in specialized laboratories. The possibility of virtual measurements is a suitable study method, not only for the reasons mentioned above but also because it offers more time for learning, which is not always available under real teaching conditions.

Keywords: antenna parameters, measurement procedures, circuit diagrams, measurement workplace, distance learning, laboratory exercise, MATLAB, Simulink

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SIGNAL GENERATION USING A DIRECT DIGITAL FREQUENCY SYNTHESIS CIRCUIT

Jozef DUBAS

Consultant: Dipl. Eng. Roman Berešík, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics, Liptovský Mikuláš

Abstract: The requirement of digital control and signal generation with different frequency and signal shape in various branches of electronic and communication equipment has brought the method of direct digital synthesis to the fore. The goal of the work is to design and implement a circuit solution of a signal generator with direct digital synthesis controlled by a microprocessor. The theoretical part of the work deals with the essence of direct digital synthesis and its principles of operation. The practical part of the work deals with the actual design and implementation of a generator with direct digital synthesis controlled by a microprocessor. It describes the individual functional elements of the generator, the overall circuit solution and the programming of the circuit itself with direct digital synthesis using a microprocessor. It also includes measurements of the basic parameters of the generated harmonic signals of the generator designed by us. The conclusion of the work thus deals with the analysis of the achieved results, verification, comparison of theoretical and practical knowledge in the field of direct digital synthesis.

Keywords: direct digital synthesis, harmonic signal, design and implementation of a generator with direct digital synthesis, direct digital synthesis controlled by a microcontroller, programming of a circuit with direct digital synthesis, measurement of generated signals

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DESIGN AND CONSTRUCTION OF PRINTED CIRCUIT BOARDS USING CNC SYSTEMS

Pavol FULLA

Consultant: Dipl. Eng. Miroslav Matejček, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics, Liptovský Mikuláš

Abstract: The design of printed circuit boards using various software tools is implemented in different software environments such as the well-known EAGLE software from AUTODESK, Altium Designer, OrCAD, Pads, KiCad, and others. The technological process of software design is largely similar in all software environments, from circuit design to the actual design of the printed circuit board. The practical construction phase of these printed circuit boards often involves removing unwanted parts of the copper foil using various alkaline solutions or concentrated acids to create the desired copper pattern on the PCB. This work focuses on the software design of printed circuit boards in the EAGLE environment (AUTODESK), where the design and construction of an astable circuit with a NE555 timer is described in detail, including circuit calculations, schematic design, and PCB layout. Based on this design and the output files of the EAGLE program, G-codes are generated using other software environments, which are used for CNC milling machines capable of removing unwanted copper to create the PCB without using aggressive and dangerous chemicals. The output files in G-code format are displayed in the Grblcontrol (Candle) software environment, which allows for the calibration and transfer of G-codes to the CNC3018 milling machine. Based on these G-code files, an astable flip-flop circuit board was also created. The conclusion of the work focuses on evaluating the results of the astable flip-flop circuit board manufactured on a CNC3018 milling machine. The main contribution of this work is the detailed explanation of the innovative process of designing and implementing PCBs using CNC systems.

Keywords: Astable flip-flop, Ne555, CNC 3018, CNC milling machine, Eagle, PCB

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RTLS UWB SYSTEM FOR DETERMINING THE SOLDIERS INDOOR POSITION

Matej MALINA, Patrik ŠUJETA

Consultant: Maj. Dipl. Eng. Stanislava Gažovová, PhD.,
Assoc. Prof. Dipl. Eng. Martin Marko, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics,
Liptovský Mikuláš

Abstract: The paper focuses on positioning in buildings without the use of Global Navigation Satellite Systems (GNSS). Systems can be used in the training of small combat units in buildings and thereby contribute to increasing the effectiveness of training. The paper presents a theoretical analysis of the Time Difference of Arrival (TDOA) method. The practical part includes an experimental verification of positioning by the TDOA method depending on the location of the tag on the soldier. The system from Sewio Networks s.r.o. was utilized to perform experimental measurements aimed at determining the location of equipment in industrial halls. Measurements were carried out in a laboratory that was equipped with office and technical equipment. This laboratory equipment causes multiple reflections of the measurement signals, which simulate the real environment of the expected deployment of the system.

Keywords: Indoor monitorins, Position systems, Buildings,, training, Time Difference of Arrival, Ultra wide band

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INTELLIGENT FLIGHT STICK DESIGN

Jakub NECHVÁTAL

University of Defence, Brno, Czech Republic

Abstract: The research paper deals with the conceptual design of an intelligent flight stick with movement anlyzing capabilities to gather data about its motions when in use with a simulator. The intelligent flight stick is a project aimed at developing a device based on a micro processing unit that will emulate the actions of an analogue joystick, process the information and pass it onwards into a computer station running a flight simulator (in this case we'll be dealing with X-Plane10). The main point of this design is to allow for multiple functions that build upon the analogue joystick, the main function that is present at this moment is data gathering and display of the flight stick's actual position in real time for analysis purposes. The graphical display of the current position can be accessed by any device that is capable of running a web browser that isn't „outdated" by today's standards. The device itself is structured in 3 different parts: The analogue joystick, an Arduino micro development board and an esp32 development board. The Arduino's purpose is it's ATmega32U4 microprocessing unit, which allows us to make a simple HID (Human Interface Device). The ESP32's main presence is mainly due to its Wi-Fi and better hardware capabilities. Together with the joystick, these 3 parts make a system that interfaces with any personal computer running a flight simulator. Finally, the paper denotes the current state of the project, as well as future plans for further development.

Keywords: Data analysis, flight stick, measurement

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OPTIMIZATION OF LOUDSPEAKER CONSTRUCTION FOR SOUND REPRODUCTION IN ACOUSTICALLY NON TREATED ENVIRONMENT

Radovan PEKAR, Adrián SEMANČÍK, Jakub SOĽUS

Consultant: Col. Dipl. Eng. Rastislav Ledaj

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics, Liptovský Mikuláš

Abstract: In this paper, we discuss the optimization of loudspeaker construction for sound reproduction in acoustically non-treated environments. The goal of this study is to identify the most important factors that influence loudspeaker performance in these types of environments and to develop an optimized loudspeaker design that can produce high-quality sound under these conditions. We begin by discussing the challenges associated with sound reproduction in acoustically non-treated environments, including issues with frequency response, distortion, and interference. We then describe a set of experiments that were conducted to investigate the impact of loudspeaker design factors on sound quality in these environments. Finally, we discuss the results of these experiments and propose an optimized loudspeaker design for use in acoustically non-treated environments.

Keywords: Room Acoustics, Sound Reproduction, Line Array, Loudspeaker Design

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PROCESSING SIGNALS WITH INTRAPULSE MODULATION USING CORRELATION RECIEVER

Vanessa PETÉNYIOVÁ

Consultant: Maj. Dipl. Eng. Stanislava Gažovová, PhD

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics, Liptovský Mikuláš

Abstract: In radiolocation, signals with intrapulse modulation are often used for their robustness against interference and better energy ratio in both signal reception and transmission. This thesis discusses processing signals with intrapulse modulation within correlation reciever. Other types of recievers are also viable, but correlation reciever has many advantages, such as it's versitility, as it can be used for all types of signals with intrapulse modulation. The first chapter contains basic descriptions of signals with intrapulse modulation. The second chapter describes theoretical analysis of a correlation reciever for processing signals with intrapulse modulation. The last chapter focuses on the practical part of the thesis and contains models of transmitters of signals with intrapulse modulation, model of correlation path and a model of correlation reciever. Individual subchapters describe and visualise the results. Additionally, these results are contain the the thesis conclusion.

Keywords: signal, intrapulse modulation, reception, processing, correlator

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MODELING OF ELECTRONIC CIRCUITS FOR DISTANCE LABORATORY MEASUREMENTS

Denisa POĽAŠKOVÁ

Consultant: Assoc. Prof. Dipl. Eng Zdeněk Matoušek, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics, Liptovský Mikuláš

Abstract: The work presented at the student scientific conference (SSC) deals with the design and creation of laboratory exercises for electronic circuits for distance form of education. The measurements are carried out in the MATLAB-Simulink software environment. The work is divided into two parts. The first part describes the methods of measurement, supplemented by diagrams of measurement workplaces. In the second part, the measurements are designed in the MATLAB-Simulink software environment using three different methods (measured values, using blocks, and approximation of values). The results of the work at the SSC are presented in the second part of this work. This work should serve as a guide for measuring the parameters of electronic circuits and also be usable for distance learning. Its goal is to bring cadets as close as possible to the processes and procedures for real measurements of receiver and transmitter parameters, which are carried out as part of laboratory exercises in specialized laboratories.

Keywords: MATLAB, Simulink, transmitter, receiver, electornic circuits, measurement

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AUTOMATIC MEASUREMENT OF THE VOLTAGE-CURRENT CHARACTERISTIC OF UNIPOLAR TRANSISTORS USING A MICROPROCESSOR

Ľuboš VIDIEČAN

Consultant: Dipl. Eng. Zdeno Baráni, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Electronics
Liptovský Mikuláš

Abstract: The issue of investigating the volt-ampere characteristics of unipolar transistors is important for the specific application of unipolar transistors in electric circuits. The aim of the presented thesis was to develop a design of an automatic system for measuring electrical quantities (voltage and current) of the volt-ampere characteristic of a unipolar transistor. The first part of this thesis focuses on the theoretical definition of unipolar transistors, their classification, characteristics, and operating principles. The second part describes the individual components used in the design of the automatic measurement system for the volt-ampere characteristic of a unipolar transistor. Last but not least part describes the design of the automatic measurement system for the volt-ampere characteristic of a unipolar transistor, which consists of a description of the electrical circuit production, including the circuit diagram and source code for the microprocessor. In the final part of the presented thesis was evaluated results of the volt-ampere characteristic of the unipolar transistor.

Keywords: volt-ampere characteristic, transistor, FET transistor, MOSFET, microprocessor, DAC converter

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SECTION: SOCIAL SCIENCES; NATIONAL AND INTERNATIONAL SECURITY

THE IMPACT OF INTERNATIONAL CRISIS MANAGEMENT ON THE SECURITY ENVIRONMENT IN IRAQ

Matúš MACKO

Consultant: Assoc. Prof. Dipl. Eng. Vojtech Jurčák, CSc.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defence
Liptovský Mikuláš

Abstract: The aim of this thesis is to assess the impact of international crisis management on security in Iraq through the analysis of theoretical knowledge and subsequent synthesis. We made hypothesiss based on facts. Based on historical experience, our findings, and the experience of the members of the Slovak Armed Forces deployed in Iraq, we form our own evaluative stance. The mistakes that happened in Iraq can be avoided in the future. This learning is one of the possible purposes of this work in the future. The thesis can also serve as a study material for the preparation of future civilian and military participants in international crisis management missions.

Keywords: Iraq, missions, security

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ARMED FORCES IN NATIONAL CRISIS MANAGEMENT

Samuel GROHOĽ

Consultant: Maj. Dipl. Eng. Dušan Hrnčiar

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defense, Liptovský Mikuláš

Abstract: Expert work is focused on the operation of the armed forces in national crisis management, especially on the impact of natural disasters. In the thesis we paid attention specifically to floods and the subsequent recovery from the consequences of this crisis phenomenon and the subsequent assistance to the civilian population. One of the main tasks of the Armed Forces of the Slovak Republic is to assist the components of the integrated rescue system in dealing with such crisis phenomena and to provide assistance in removing the consequences of natural disasters. It is the armed forces that have the means, equipment and personnel to deal with such crises, and it is one of the tasks in dealing with crisis phenomena within the framework of national crisis management that the 53rd Field Service Battalion in Hlohovec is dealing with.

Keywords: armed forces, national crisis management, crisis phenomena, natural disasters, floods

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INVOLVEMENT OF MEMBERS OF THE ARMED FORCES OF THE SLOVAK REPUBLIC IN THE OPERATION EUFOR ALTHEA

Aneta CHOMOVÁ

Consultant: Assoc. Prof. Dipl. Eng. Ivan Majchút, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defense, Liptovský Mikuláš

Abstract: Operation EUFOR Althea is a European Union military mission in Bosnia and Herzegovina. Members of the Armed Forces of the Slovak Republic (AFSR) have been involved in the mission since its inception in 2004, mission was launched by the European Union after the conflict that occurred in the 1990s.
The AFSR provides troops and logistical support to the mission, which aims to maintain peace and stability in the region. Slovakian soldiers have served in a variety of roles within the mission, including as peacekeepers and military observers, they has also contributed to the training of the Armed Forces of Bosnia and Herzegovina.
Slovakia´s involvement in EUFOR Althea is part of its broader commitment to international peacekeeping and security operations. The involvement of AFSR in operation has been seen as positive development for both the AFSR and the wider international community. It has provided an opportunity for the AFSR to demonstrate its commitment to international peace and security, and it has allowed the AFSR to gain valuable experience and training in a multinational military operation.
The aim of this work is to examine and analyze the participation of Slovak Armed Forces in the EU-led military mission in Bosnia and Herzegovina.

Keywords: Bosnia and Herzegovina, NATO, EUFOR Althea, EU, AFSR

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CHINESE THREADS TO EUROPE AND THEIR POSSIBLE SOLUTIONS

Jozef LENHART

Consultant: Dipl. Eng. Viera Frianová, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defence, Liptovský Mikuláš

Abstract: The increasing influence of China, driven by the aspirations of its ruling Communist Party (CCP) and the Chinese Liberation Army (CLA), poses a multifaceted threat to Europe's economy, safety, and political structures. The escalating tensions surrounding Taiwan and the potential for conflict further raise these concerns, jeopardizing Europe's stability and security. Additionally, China's Belt and Road Initiative (BRI) expands its economic influence, generating dependencies that can be leveraged for geopolitical advantage. To counter these challenges, European nations must adopt a unified approach that includes diplomatic engagement, the promotion of democratic values, and the strengthening of regional institutions. By collaborating and fostering resilience, Europe can effectively address the threats presented by China's growing influence, ensuring a more secure and prosperous future for the continent.

Keywords: : China, CCP, CLA, Taiwan, war, BRI, economy, Europe, security

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DEVELOPMENT AND MEANING OF FORTRESSES IN 17. AND 18. CENTURY

Richard SÝKORA

Consultant: Dipl. Mgr. Juraj Šimko, PhD.

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defense, Liptovský Mikuláš

Abstract: Development and meaning of fortresses in 17. and 18. century describes many important aspects of building a fortresses and fortifications with problems that builders of fortresses face in layout of defense components and terrain features. Defense components are described in detail and according to the historical documentation. The main idea of this topic is to introduce this work to the non-professional publicity and present details about engineers like, Marquis de Vauban and many others very important pioneers that take their part in development of this phenomenon and last but not least I want to share some siege art of this era that was needed to conquer fortresses, and how to hold defenses as effective as possible.

Keywords: Siege, Defense, Fortresses, 17. Century, 18. Century, Engineering, Building

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ASSESSMENT OF THE APPLICATION PRACTICE OF THE PRINCIPLES OF GOOD PUBLIC ADMINISTRATION IN THE CONDITIONS OF HIGHER EDUCATION

Lea TOMKOVÁ

Consultant: JUDr. Tomáš Martaus

Armed Forces Academy of General Milan Rastislav Štefánik, Department of Security and Defense, Liptovský Mikuláš

Abstract: The student's scientific professional work deals with the issue of applying the principles of good public administration in administrative proceedings between the university and the student. Also by observing them in administrative proceedings, since according to the Charter of Fundamental Rights of the European Union, everyone has the right to have the institutions, bodies, offices and agencies of the Union deal with their affairs impartially, fairly and within a reasonable period of time. The work includes a theoretical interpretation of administrative law and good public administration, an assessment of the application of the above-mentioned principles in the analysis of the judgment of the Supreme Court of the Slovak Republic and a case study with recommendations for practice with the aim of achieving the principle of legality in the activities of the Academy of the Armed Forces of General Milan Rastislav Štefánik in the process of expulsion from studies. which were created on the basis of a survey carried out using the inquiry method.

Keywords: administrative law, administrative procedure, good public administration, judgment, principles

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ABSTRACTS

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