



Faculty of
Telecommunications
Technical University - Sofia
Sofia, Bulgaria



Faculty of Electronic Engineering
University of Niš
Niš, Serbia



Faculty of Technical Sciences
St. Kliment Ohridski University
Bitola, North Macedonia

2021 56th INTERNATIONAL CONFERENCE ON INFORMATION,
COMMUNICATION AND ENERGY SYSTEMS AND TECHNOLOGIES

ICEST

June 16-18, 2021, Sozopol, Bulgaria

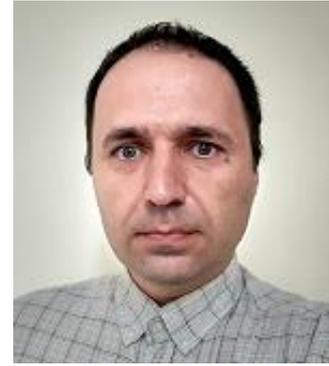
Abstracts of Papers



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Dear Colleagues and ICEST Friends,

The 56th International Scientific Conference on Information Communication and Energy Systems and Technologies – ICEST 2021 was held from June 16 to 18 in Sozopol, Bulgaria. The Conference is jointly organized by the Faculty of Telecommunications, Sofia, Bulgaria, the Faculty of Electronic Engineering, Niš, Serbia and by the Faculty of Technical Sciences, Bitola, N. Macedonia. As to the earlier ICEST conferences many authors from all over the world submitted their papers. This year 57 papers have been accepted for oral or poster presentation. The plenary lecture is given by Dr. Alessia Amelio, independent researcher from Italy. I am glad that, although in a hybrid environment, all participants took the opportunity to exchange their knowledge, experience and ideas, and also made contacts and established further cooperation. This year we have provided a calm atmosphere with the opportunity for meetings in accordance with the anti-epidemic requirements. I hope to meet at the next ICEST conference.

Assoc. Prof. Dr. Kalin Dimitrov,

ICEST 2021 Conference Chair

ICEST'2021 Abstracts of Papers

Plenary Lecture

Amelio, A., Data science methods in healthcare: a research perspective

In recent times, artificial intelligence and data analysis approaches are gaining special attention in the healthcare context. Innovative methods in this direction are being introduced as a problem solver for different healthcare targets, including hospitals, clinics, healthcare companies and private medical offices. In this talk, an overview of artificial intelligence and data analysis approaches in the healthcare domain is presented, with particular reference to the pandemic situation of COVID-19. Specifically, innovative methods are introduced and contextualized in different case studies related to statistical analysis of COVID-19 data, and segmentation and clustering of medical images. A new IT system is also presented, which improves the diagnosis process of stroke lesions from CT images.

Computer Systems and Internet Technologies

Jankovic, R., I. Mihajlovic, A. Amelio, I. Draganov, Predicting the Ecological Footprint: A Case Study for Italy, Pakistan and China (Invited Paper)

This paper introduces a new prediction model of the ecological footprint from energy parameters based on time series vector autoregression. The experiment employs global yearly observations of the variables in the period 1971-2014 for three countries: (i) Italy, (ii) Pakistan, and (iii) China. A prediction is performed for each variable adopted in the model from 2015 to 2024. The obtained results indicate that the total ecological footprint of consumption will increase for China and Pakistan, and decrease for Italy.

Dimitrova, E., D. Dimitrova, V. Dimitrov, V. Trifonov, Contemporary Authentication Access Approach for High Security Information Systems

In this paper, a reliable method for access to information systems that require an increased level of security is proposed. In addition to the username and password, the individual's handwriting can be used as a second level of authentication. It is less invasive than the fingerprint and iris recognition and its technical implementation is not difficult and expensive.

Georgiev, G., O. Panagiev, Unsubscribe rate of chatbots users received broadcast messages for France, Germany, Russia and the Global market

This paper shows the chatbot users unsubscribe rate when they receive a weekly broadcast message. This research tracks the unsubscribe rate for a Viber application in four different locations – France, Germany, Russia, and Global (all users in countries that are not part of the first three).

Quantitative data regarding broadcast messages has been analyzed. We have similar user groups based on location, platform, first interaction, and sent messages.

Nikolov, N., O. Nakov, D. Gotseva, Operating systems for IoT devices

In this paper are described and compared the operating systems for IoT devices. There are so many operating systems and to make the right choose what to use is very complex. There are described most used RTOS in IoT and they are compared. Depending on the application, the appropriate RTOS for IoT must to be selected.

Nikolov, N., O. Nakov, D. Gotseva, Research of MQTT versus LwM2M IoT communication protocols for IoT

In this paper are described and compared the MQTT and LwM2M communication protocols for IoT devices.

They are described their specifics, basics, software realization, type of usage and for what case are most suitable. To make the right choose of IoT communication protocol for usage is very complex. They are compared according specifics, application purpose and idea of IoT protocols. Depending on the application, the appropriate IoT communication protocol must be choosed.

Yosifova, V., D. Chikurtev, Communication system for remote control of infrared heating

The paper presents a communication system for remote control of infrared heating. The system is based on internet technologies, Smart home technologies, IoT and LoRa technologies. The structure of the proposed system and the applied technologies used are described. The possibilities for the system architecture are presented. The application of the system will be reviewed as future possibilities in energy-efficient heating.

Digital Signal and Image Processing

Kirilov, N., Kirilova, E., Classifying Dual-Energy X-ray Absorptiometry Images Using Machine Learning

In this paper we study the ability of machine learning or convolutional neural networks in particular to be trained to classify dual-energy x-ray absorptiometry images of the spine and hip. For this purpose we create models which could differentiate images with healthy bone from images with pathology.

Kurochka, K., K. Panarin, An algorithm of segmentation of a human spine X-ray image with the help of Mask R-CNN neural network for the purpose of vertebrae localization

Diagnosing osteochondrosis is carried out by determining the geometrical parameters of the vertebrae and their relative position. An algorithm based on the use of the Mask R-CNN convolutional neural network is proposed to localize the vertebrae on x-ray images of the lumbar spine and determine their geometric parameters.

Terneva, Z., I. Vladimirov, D. Nikolova, Accessing LinkedIn and Google E-mail Databases Using Kali Linux and TheHarvester

In this scientific paper, a test is made on how reliable and secure databases are. The simulation shows how easily hackers can access a database and use its contents maliciously. It is performed on a virtual machine Kali Linux using software program - TheHarvester. People's personal email addresses have been used and shown for educational purposes only. The aim is to analyse the accessibility of data collections.

Vladimirov, I., D. Nikolova, Z. Terneva, Overview of Methods for 3D Reconstruction of Human Models with Applications in Fashion E-commerce

In this scientific paper, an overview of different methodologies and algorithms used for the reconstruction of 3D human models from 2D videos of people in action is presented. These methods could be applicable in the growing e-commerce business. Due to emerging challenges of global warming and the coronavirus pandemic, many developments in the apparel industry must be made in order to make the branch more sustainable and eco-friendly. In this time of globalisation, many brands produce and sell their items internationally and use

long-distance shipping to distribute and deliver to their shops and clients. With online shopping, there is a big concern with clothing being the “wrong size” or “wrong item”. To tackle this problem companies, offer their clients the opportunity to return ill-fitting items, but that is a problem in itself, because it increases their carbon footprint and it creates unnecessary pollution. A possible solution may come from the use of a computer vision application – the development of a system for size estimation or trying on clothes virtually.

Nikolova, D., I. Vladimirov, Z. Terneva, Human Action Recognition for Pose-based Attention: Methods on the Framework of Image Processing and Deep Learning

This paper presents an overview of some approaches of Human action recognition (HAR) for pose-based attention. The paper focus is on algorithms that use video processing on a given dataset. A list of the best HAR datasets is given in order to show the variety of the available videos online. Local and Global feature extraction are reviewed. Also some of the most common Deep Learning methods are studied: Recurrent Neural Network (RNN), Convolutional Neural Network (CNN) and Generative Adversarial Network (GAN). All of the methods are directed to recognise the pose and the focus of the person in a recording.

Christoff, N., Improving a Digital Elevation Model of Mars Based on Principal Curvature Directions

This article aims to show and eliminate systematic errors in the data, which are expressed in visible anomalies in the visualization of the surface of Mars. We propose a method for their filtration to improve the quality of the digital elevation model of Mars.

Mironov, R., I. Draganov, Local Adaptive LMS Filtration of Multidimensional Images

In this paper a new method for local adaptive three-dimensional filtration of multidimensional halftone images is presented. The adaptation is based on the local information from the neighbourhood pixels of processed 3D image using generalized 3D LMS filter. An analysis of the quality of the processed multidimensional images is made on the basis of the calculated PSNR, SNR, MSE and the subjective observation. The given experimental results from the simulation in MATLAB environment for operating systems Windows of the

developed filtration algorithms, based on a set of real test images are presented. By using the adaptive 3D LMS algorithm the average signal to noise ratio improvement is about 3 dB.

Georgieva, V., P. Petrov, D. Tsvetkova, L. Laskov, MRI/SPECT Image Fusion of Brain Based on Multi-Scale Wavelet Decomposition

This paper presents a study on the possibilities offered by the multi-scale wavelet decomposition in the medical image fusion of the brain obtained by MRI and SPECT technology. The influences of various discrete wavelet functions by which the decomposition was obtained and the corresponding level at which it was constructed are analysed. The implemented study and the results obtained using real images would be useful in making a more precise diagnosis.

Ivaylov, I., M. Lazarova, A. Manolova, Multimodal Motor Imagery BCI Based on EEG and NIRS

Brain-computer interface comprises technologies for brain activity identification used in many application fields such as motor imagery, disease or mental state detection. Multimodal approach that utilizes hybrid data can be improve motor imagery classification. The paper explores utilization of several classification techniques for multimodal electroencephalography (EEG) and near-infrared spectroscopy (NIRS) data classification in motor imagery BCI. Five classifiers used in the evaluation are Logistic Regression, K-Nearest Neighbours, Support Vector Machines, Linear Regression, SVC Radial Basis Regression and their performance is compared on EEG and EEG+NIRS datasets for motor imagery tasks classification.

Pavlova, M., A Comparison of the Accuracies of a Convolution Neural Network Built on Different Types of Convolution Layers

The development of artificial intelligence aims to increase its reliability, which is determined ambiguously by accuracy. The accuracy increase is key conception in DNN and AI at all. There is a strong relation between training the DNN and accuracy so the training is very important and very complicated. For that reason, looking for high accuracy in fire recognition it is made research a part of which will present in this article. We presented Convolution Neural Network (CNN) created by Python with Keras library can be very useful in early forest fire detection. To improve the accuracy is made private database with fire and smoke pictures exclusively. We tested two CNN architectures and Batch normalization

in these architectures. The distribution of each layer's inputs change during training as the parameters of previous layer changed make the training mode complicated. Without claiming a single indicator, the training mode is expressed by trainable and non-trainable parameters related with Batch normalization layer in CNN. The influence of Batch normalization on accuracy are presented in tabular form. The accuracy comparison of two architectures with different layers in CNN is presented in tabular form.

Djamila, Z., S. M. Meriah, F. Derraz, L. Merad, A planar MIMO UWB array design for high-resolution microwave imaging

In this paper, a planar multiple input multiple output MIMO UWB array is proposed for 3D microwave imaging applications. According to the virtual array concept, the advantage of the MIMO array lies on improving the angular resolution with a reduced number of antennas, and achieve the same resolution as a fully populated conventional arrays. In addition, the UWB systems provide a better range resolution thanks to their large bandwidth. The frequency diversity and its influence on the system's resolution is also studied. For the MIMO array, an optimal UWB antenna element is designed with more than 128% of fractional bandwidth with no considerable distortion of the transmitted impulse. For the imaging algorithm, the Back-projection algorithm is implemented and used for the reconstruction of the images. In order to study the performance of the designed system, the full-wave electromagnetic simulator CST MWS is used which allow the modelling in three-dimensions (3D). The resulting images of a different target materials and dielectric properties confirm the reliability of the proposed system and the impact of the spatial and frequency diversity in the resolution improvement while considerably reducing the cost of the MIMO UWB array.

Kostić, I., G. Stančić, S. Cvetković, Sensitivity of notch filters realized by parallel connection of allpass subfilters

The different structures of digital notch filters realized as parallel connection of two allpass subfilters are investigated in this paper. The research was done for notch filters with only one notch frequency. The influence of filter coefficients quantization on filter characteristics is analysed for three configurations and the results are displayed. Unlike Butterworth and elliptic filters it is shown that notch filters realised as parallel connection of two allpass filters remain selective even in case the coefficients are represented with only three fractional bits. All given results are obtained using Matlab® package.

Draganov, I., R. Mironov, 3D SUSAN Filtering of CT Images with Adaptive Selection of the Brightness Threshold

In this paper a new application of the Smallest Univalued Segment Assimilating Nucleus (SUSAN) filter is presented aimed at reducing the Additive White Gaussian Noise (AWGN) in Computed Tomography (CT) images. The original 2D implementation of the filter is extended in 3D and scheme for adaptive selection of the brightness threshold is proposed. Testing over large set of CT images reveal its applicability for the purpose and better performance than the 3D Gaussian and Average filters. The current modification of the 3D SUSAN filter is considered also applicable for filtering of other types of 3D images, such as MRI, multispectral and others.

Stošić, B., Improved Classes of CIC Filter Functions: Design and Analysis of the Quantized-Coefficient Errors

The paper proposes the use of identical and non-identical CIC (Cascaded-Integrator-Comb) sections in generating novel classes of selective, highly effective and low complexity filters, for communication systems. The improved classes are described by analytical method in a compact explicit form. Also, analysis of the effects of coefficient quantization is in focus. The quantized-coefficient errors are considered here based on the number of bits and the implementation algorithms.

Engineering Education

Yordanova, M., An Approach to Application of the Event Tree Analysis for Electrical Safety Risk Assessment

The paper proposes to use the event tree analysis (ETA) when the risk at working in electrical workplaces is assessed, and more precisely - when the exposure and the probability of occurrence of a dangerous event have to be determined. The event tree analysis is also very useful in the educational process of students or electrical staff.

Yordanova, M., Application of the Situational Teaching Method in the Electrical Safety Education

The purpose of the paper is to share the experience in the education of students, using the situational method for the acquisition of knowledge and skills

in the field of the electrical safety. Two examples of the application of the situational method on the safety rules of a permit-to-work are presented.

Valkovski, T., K. Dimitrov, Reception of audio signals received from different LEDs used in the low cost LI-FI systems

In this article we will discuss the possibilities of using different LEDs in low cost LI-FI systems. The results of the studied LEDs, their advantages and disadvantages will be analysed. The presented LI-FI systems are designed in order to use a minimum number of electrical elements in order to design and build such systems by students during laboratory exercises as a practical exercise. The main goal is to acquaint students with the advantages of LI-FI systems.

Terziev, V., T. Valkovski, K. Dimitrov, I. Damyanov, Monitoring of disk brakes vs drum brakes using infrared thermography

In this article we will examine the principle of operation and characteristics of infrared thermographs; Their applications in the monitoring of braking systems. We will make experimental measurements of the temperature distribution in the braking systems at rest and at different loads. We will analyse the obtained results.

Sheiretsky, K., S. Antonov, Formal Method for Finding Asymptotic Approximations

A method is presented in which, through formal procedures, we can find the desired approximation in the decomposition of functions, differential equations and integral equations into asymptotic series. With this method we get only the approximation we are interested in. An "asymptotic bracket" has been introduced, the rules by which it is used have been defined and specific examples of its application have been given.

Vasileva M., Using simulation modeling to study overvoltages in the electrical networks

Overvoltages are one of the main causes of damage to electrical networks and equipment. Detailed calculation of overvoltages in electrical networks is possible only by using computer equipment with appropriate software. This paper presents one of simulation models of the electrical networks, which are developed

for training students in the discipline "High Voltage Technics", options for conducting research and results of simulation model research.

Anackovski, F., M. Kostov, R. Pasic, I. Kuzmanov, The Impact of Industry 4.0 on Education and Future Jobs

The subject of this paper is the analysis of the Impact of Industry 4.0 on Education and Future Jobs. The purpose of this paper is to explore the impacts of recent trends and characteristics related to digital transformation in the field of Education and Future Jobs, namely, to further understand how such a digital transformation will transform the modern living and working. Some jobs will not exist, other jobs going to be developed, and new jobs that do not exist these days will become usual. What is known is that in the future will be required new skills to master.

Laskov, L., V. Georgieva, Analysis of Amplitude Modulation and Demodulation in MATLAB Simulink Environment

This paper presents an approach for studying the amplitude modulation and demodulation. An algorithm for the laboratory exercise and block diagrams for MATLAB Simulink used in it, are presented. This allows students to study the effect of different parameters of the carrier and information signals, of the modulator and demodulator and of the communication channel, on the modulated and demodulated signal.

Trushev, I., S. Sehati, D. Patil, On the Minimal Fire Power for Heat Detection

Unwanted and unplanned fires have always caused damages to human life and economy. Consequently, in order to predict, control, and extinguish them, fire detectors and sprinklers are widely used. What detectors could sense resulting from or causing fire for the purpose of fire management and how they react is described here. A model for minimal fire power for heat detector activation is described and results are presented.

Energy Systems and Efficiency

Mehmed-Hamza, M., A. Filipov, M. Ivanova, Research and Analysis of Faults in Medium Voltage Distribution Grids

The paper presents data from a study of the faults and relay protections trips in a 110/20 kV substation for a period of two years. A research on the automatic

trips of relay protections depending on the type of the fault and the type of power lines for a year and for each month separately has been made.

Parushev, P., Study of Hydrogen Production by Electrolysis of Spring Waters from Bulgaria

Bulgaria ranks second in natural water reserves in Europe. Much of the spring water flows back into nature without further utilization. This report examines the possibility for production of hydrogen by electrolysis of natural spring water in Bulgaria. Laboratory electrolyzer Helex/NI was used. Experimental results were obtained determining the theoretical possibilities for hydrogen extraction. A block diagram of an installation using renewable electricity is proposed.

Atanasovski, M., M. Kostov, B. Arapinoski, M. Spirovski, Integration of New RES in Power System of North Macedonia

The goal of the paper is to investigate and evaluate the impact of integration of new planned renewable energy sources (RES) on the operating parameters of the transmission networks. The paper presents methodology and algorithm for developing software module for RES impact assessment on the elements loading of the transmission networks (lines and transformers) and on network buses voltages within grid code defined limits and short circuit currents level. According to the methodology software module is developed using PYTHON platform. The integrated calculations in the module are part of standard planning mechanisms of power system and maintaining the predefined level of security of supply and reliability of power system elements and substations. The module is tested and evaluated on transmission network individual forecasted model of power system of North Macedonia for the year 2025.

Kalinkov, K., V. Markova, T. Ganchev, The Effect of Acute Stress on the Performance of Students in Engineering Education

In the presents paper, we summarize the results of a recent study on the relationship between task-caused acute stress and students' performance. Our experimental protocol was based on the CLAS dataset, which contains physiological signals of 60 students. The physiological recordings were captured during students' involvement in five different tasks, including three interactive tasks (Stroop test, Math test, IQ test) and two non-interactive tasks. The non-interactive tasks aimed at emotion elicitation via blocks of sixteen photographs

and sixteen emotional music video clips, purposely selected to cover the entire arousal-valence space. We observed that the three Stroop, Math and IQ tests cause higher acute stress levels than pictures and musical stimuli purposely selected to provoke emotional reactions. The experimental results show that acute stress has different effects on students' academic performance, depending on their gender and individually. Specifically, in contrast to the females, males were observed to show lower stress levels in the Math test. At the same time, males were observed to be less concentrated on the Stroop test. We observed that heart-rate variability (HRV) could be used as an indicator of the students' performance under stress as it is not related to students' abilities.

Popovski, P., G. Veljanovski, B. Arapinovski, M. Atanasovski, Electromagnetic Analysis of Synchronous Generator

It is very well known that three-phase electrical machines are an irreplaceable component in the industry, as well as many other areas in everyday life. Among these machines, synchronous generators are essential when it comes to power production. Having this in mind, it is to be expected that analyzing these machines are of key importance, whether it comes to designing, operating or maintenance of synchronous generators. This paper aims to cover the electromagnetic analysis of this particular type of machine: more specifically a three-phase synchronous generator. The analysis was performed using the finite element method. A relatively wide range of data was obtained from the analysis, and the results from it are presented and interpreted in this paper.

Strejovski, I., N. Acevski, M. Spirovski, Application of Matlab Tool for Analysis of Complex Grounding Systems of Overhead Power Lines

In the paper, first it is said in general what is meant by grounding system, the need for protection as well as the consequences in case of overvoltage. The procedure for solving a complex grounding system at overhead lines is further presented, with the manner of exact modelling of a real overhead power line. In the main part, by applying the already mentioned procedure on a real example of the transmission power line Bitola - Prilep through a developed application in MATLAB, the grounding system will be solved in case of short circuit on the towers. Finally, the step and touch voltages will be presented and a conclusion will be made whether those values are within the normal range.

Gade, S., R. Agrawal, D. Patil, S. Antonov, Optimal utilization of UPQC at Different Operating Condition Using TLBO

Optimal use of DVR for load reactive power sharing increases the utilization of overall UPQC system, efficiency and reliability. In present paper an attempt is made to find the optimal utilization of both PECs to minimize VA loading of overall UPQC system using Teaching Learning based Optimization is proposed. The simulation results demonstrate the efficacy of TLBO.

Radio Communications, Microwaves, Antennas

Petkova, D., P. Petkov, Aperture-Coupled Microstrip Patch Antenna Design using FEM Simulation Technique

The recent developments in microwave systems, put high requirements to antenna arrays for RFID and radar applications, in terms of pattern shape and side lobe specs. The presented paper discusses an inexpensive approach for amplitude distribution control of aperture-coupled microstrip patch antenna, as a building block of more complex array systems.

Nachev, I., I. Iliev, Improving an antenna radiation pattern using photonic band gap structure

Photonic band gap (PBG) structures are innovation technology for improving radiation characteristic of different antenna types. In this work the improving an antennas radiation characteristics using a PBG structure is discussed. The studied structure leads to narrowing the antenna radiation pattern beamwidth and increasing the antenna gain. The results are verified using simulations and experimental measurements.

Arslan, I. A., G. Altin, A Novel Deep Neural Network Based Antenna Selection Architecture for Spatial Modulation Systems

With the constantly developing technology, the speed and accuracy requirement of communication systems are increasing day by day. Spatial modulation (SM) is a recent and promising technique which additionally uses antenna indices for multiple input multiple output (MIMO) systems. In order to add another degree of freedom to SM's efficiency, transmit antenna selection (TAS) algorithms are a crucial field to study. On the other hand, use of artificial intelligence significantly developed in nowadays in wide variety of areas such as biology, robotics, automation etc. The main purpose of this study is to realize TAS for SM systems using deep neural network (DNN). Besides, the processing load

of the proposed DNN is reduced without involving the repetitive parts of the TAS metric which is not studied in the literature as far as we know. It is shown that the proposed DNN based TAS algorithm outperforms existing studies in terms of symbol error rate.

Kumar, V., H. Singh, K. Saxena, B. Bonev, R. Prasad, Approximations for ITU Rain Model using Machine Learning

In communication technologies, availability is the key performance matrix. Different factors which affect the availability of links are hardware reliability, finding interference etc. In radio wave propagation studies, attenuation caused by hydrometeors like rain plays an important role especially for higher frequency bands. Different models are there for the prediction of attenuation caused by rain out of which ITU-R model is one of the widely acceptable models. In this paper, K-Means algorithm is used to propose an improved ITU-R model. Proposed model can make up the shortcoming of ITU-R model to determine the break-up points in frequency range and obtained soft clusters have been trained by machine learning algorithms then proposes a mathematical model for prediction of radio wave attenuation due to rain. Results from proposed model compared with ITU-R model.

Singh, H., V. Kumar, K. Saxena, B. Bonev, R. Prasad, Prediction of Radio Wave Attenuation due to Cloud using Machine Learning Techniques

The latest development in wireless technology has resulted in a surge in demand for higher frequency bands from all corners of the mobile industry. As next-generation mobile technology advance at a breakneck pace and the world moves to an online platform, technologies that provide faster internet with no lag are needed. Owing to the availability of higher bandwidth, millimetre waves and sub-millimeter waves are better candidates for this form of operation. These higher frequencies are hampered by environmental attenuation caused by rain, fog, dust, and other factors. In the case of satellite communication, cloud-induced radio wave attenuation is important. For calculating attenuation, various models such as ITU-R, Slobin, Gunn, and others are available, but ITU-R is the most commonly accepted. Water droplet dielectric constants are determined by calculating attenuation using the ITU-R model. Using machine learning techniques, a new method for measuring the real and imaginary parts of the dielectric constant of a water droplet is presented in this paper. The proposed model's results are compared to the ITU-R model's. In comparison to the ITU-R

model, the proposed model has the advantage of being very straightforward since it includes quadric equations.

Stojanovic, M., N. Sekulovic, A. Panajotovic, P. Popovic, M. Protic, Wireless channel prediction using ensemble of Extreme Learning Machines

In this article, we examine the possibilities and provide justification for extreme learning machines (ELMs) ensemble application in prediction of wireless channel condition. Single-input single-output (SISO) system in environments classified as microcellular and picocellular is used for analysis of the prediction model. Effectiveness and accuracy of ensemble based ELM algorithm to predict signal-to-noise ratio (SNR) in the channel is confirmed using, as performance indicators, the normalized mean squared error (NMSE) and time consumption. Moreover, the ensemble can effectively improve the generalization of the model compared to the single ELM. The results also show that ELM scan generates diverse prediction results, even when using the same training set.

Lubih, L., I. Dochev, L. Docheva, S. Manev, Development and study of a small radar

In this paper our experience in developing a relatively inexpensive synthetic aperture radar (SAR) for educational purposes is presented. It has also been used as a simple non-imaging Doppler and FMCW radar for the first steps in an educational process with a gradually increasing complexity of the learning content. In SAR mode, the radar moves on a rail in order to ensure accurate rectilinear motion. Synchronizing pulses are produced that allow the processing software to determine the exact radar position. A sample plan for laboratory sessions conducted with this radar is also presented.

Panagiev, O., Investigation of the interference in signal transfer between different cable operators in CATV/HFC interlaced cable distribution networks

In this paper are presented the results from studying the influence between signals in subtrunk and subscriber distribution networks (STDN, SSDN) from CATV/ HFC networks of two cable operators (CO1 and CO2). Several options for signal transfer between adjacent coaxial cables in underground and overhead routes are considered.

Marinkovic, Z., G. Gugliandolo, G. Campobello, G. Crupi, N. Donato, Application of Artificial Neural Networks for Modeling of the Frequency-Dependent Performance of Surface Acoustic Wave Resonators

This paper deals with the application of the artificial neural networks (ANNs) for modeling the performance of four commercial two-port surface acoustic wave (SAW) resonators. ANNs are used to reproduce the frequency-dependent behaviour of the short-circuit input admittance, thereby enabling a fast and accurate estimation of the resonant parameters.

Electronics and Control Systems

Iliev, D., N. Madzharov, R. Ilarionov, Methods to Increase Distance in Wireless Power Transfer Systems

This paper presents a model for increasing the distance in Wireless Power Transfer systems. By introducing an additional passive LC resonant circuit it is possible to increase it approximately 2.8 times while maintaining the efficiency of the system $\eta \approx 70\%$.

Kireva-Mihova, D., K. Mirchev, B. Boyadjiev, Authorization Concept in the 4th Railway Package

The procedure for placing in service (PinS) of railway subsystems is addressed in the European Interoperability Directive (EID). The aim of the new 4th Railway Package (4th RP) is to increase the efficiency and quality of rail transport by minimizing any administrative or legal obstacle in order to develop a single European railway area in the future. In the paper the concept of authorization is reviewed with the adoption of the 4th RP. A distinction of authorization before and following the 4th RP adoption is described. The main barriers or obstacles to address such harmonized process and procedure are identified. Another objective is to investigate how the Common Safety Methods for Risk Assessment (CSM-RA) are used and perceived within an authorization process.

Brusev, T., Buck-Boost DC-DC Converter Designed for PCB Applications

In this paper is presented four-switch buck-boost dc-dc converter designed with Cadence OrCAD software tools for printed circuit board (PCB) applications. The output voltage of the converter V_{OUT} is equal to 12 V, while the input voltage V_{IN} can vary from 6.5 V to 36 V. The efficiency η of the circuit as a function of input voltage V_{IN} is evaluated. The switching frequency f_s of the

buck-boost dc-dc converter is equal to 300 kHz. The maximum output power of the circuit is 60 W. The maximum measured efficiency η of the converter is equal to 99%.

Rusev, R., G. Angelov, B. Tzaneva, M. Aleksandrova, Electrophoretic Deposition of Rochelle Salt on Cu₂O Plate

A new method for electrophoretic deposition of piezolayers is developed. Rochelle Salt is deposited over a plate of Cu₂O at a voltage of 7 V for 5 minutes. The investigation using scanning electron microscopy showed that a nanosized sublayer of microscopic crystals was grown. The generated voltage is with 622 mV amplitude. The obtained piezo module d_{33} is 223.1 pC/N which is comparable to the state-of-the-art deposition methods.

Kolev, S., Designing a NFC system

The article proposes an NFC system with NXP PN 532 chip, designed and implemented an antenna for 13.56 MHz. NFC technology is entering the Bulgarian market and is developing at a very fast pace. A large percentage of smartphones currently have NFC connection modules. In a period of several years with the introduction of NFC modules our life will be much easier, will be able to reduce the cost of access control of business and office buildings. The designed system is intended to be used for control of a patrol team.

Miletiev, R., E. Iontchev, R. Yordanov, Design of navigation system with multiband GNSS receiver with RTK and DR algorithms

The current paper discusses the navigation system based on 10DoF IMU system and multiband sub-meter level GNSS module with dead reckoning (DR) and real-time kinematic (RTK) algorithm technologies. The system may be used as a single board or may be coupled with raspberry PI systems with Bluetooth, WiFi or GPRS/3G/4G connectivity to download the differential corrections using Networked Transport of RTCM via Internet Protocol (NTRIP).

Mladenov, G., I. Damyanov, T. Valkovski, Research and selection of parameters determining the efficiency of the braking system of cars to improve traffic safety and environmental performance

The present study considers the possibility of developing an integrated system for monitoring the basic parameters of the braking system of cars in operation during the braking process. The main parameters determining the

braking efficiency of cars are the temperature of the brake system elements and the brake fluid pressure. Experimental studies and developments have been carried out to determine the temperature of the car's brake discs during braking.

Informatics and Computer Science

Genchev, P., Analysis of changes in the probability of an incident with information security

In this paper a model and analysis of the changes of the risk factors for the information security is made. The performed analyzes and conclusions allow to formulate dependencies, through which to determine the appropriate periods for checking the risk factors. These periods will ensure an acceptable level of risk that is within acceptable levels for the organization.

Mitev, Y., D. Dimitrov, IT Service Management Challenges in Condition of Pandemic and Post-pandemic Environment

Private and public businesses are experiencing massive challenges to adapt to changes caused by the 2020 covid-19 pandemic. This is impacting any business worldwide even in the cases with increasing revenue. This study describes how a company's IT is being changed from a viewpoint of pre-sales engineer, describing common patterns highlighted. The operations of IT departments are affected by the pandemic due to the reason that the main commercial activities of the companies are changed significantly. That triggers a long list of actions that needs to be considered. The most often challenges that companies reported are: remote work due to lockdown, not working or not existing Business Continuity Planning (BCP), Decreased or frozen IT budgets, priorities changes in the roadmap of IT projects, Projects freeze, Accelerated digitalization, IT budgets change.

Rogan, I., O. Pronić-Rančić, Forecasting the volume of postal services using Savitzky-Golay filter modification

In this paper, an approach for investigating the time series analysis with a goal to forecast the volume of express mail services (EMS) in international traffic in Republic of Serbia is presented. We have developed new algorithm, implemented in MATLAB environment, that is based on the non-weighted symmetric Savitzky-Golay (SG) filtering and compared to simple moving average within the seasonalized autoregressive integrated moving average (SARIMA) model. Based on data from the previous three years, actual and predicted data obtained by these two algorithms were compared and it was found that the

prediction errors of Savitzky-Golay filter modification are about 30% smaller than corresponding ones in case of SARIMA model.

Sheiretsky, K., S. Antonov, Criteria for the Existence of a Sustainable Limit Cycle. Application of the Criteria in the First Approximation for the Van der Pol Equation

The article proposes two criteria that the energy meets in order for the second-order differential equation to have a limit cycle and to be stable. The criteria were applied to establish the presence and stability of a limit cycle for the Van der Pol equation. Questions have been asked to be clarified using the method presented.

Angelevska, B., I. Andreevski, V. Atanasova, Crowd-sourcing: Citizens as scientists for air pollution monitoring

The architecture of crowd-sourced monitoring based on sensor - smart phone - server platform is analyzed for the town of Bitola, Republic of North Macedonia. Recommended crowd-sourcing possibilities include integration with current monitoring system, creation of air quality management system and regulation of urban traffic in the town.