IC ECCO 2022

THE CONFERENCE PROGRAM AND ABSTRACT BOOK

UNIVERSITATEA TEHNICĂ
A MOLDOVEI

Electrofizica
55
ani

12th International Conference on Electronics, Communications and Computing

Technical University of Moldova

The 12th International Conference on Electronics, Communications and Computing (IC ECCO-2022): The conference program and abstract book

Conference organized by

Technical University of Moldova

Computer, Informatics and Microelectronics Faculty
Electronics and Telecommunications Faculty

in cooperation with

Academy of Science of Moldova
Information Technology and Cyber Security Service
Information Society Development Institute

Chișinău, Moldova
October 20-21, 2022

The program contains the timetable of the plenary and conference sessions of the 12th International Conference on Electronics, Communications and Computing.

About IC ECCO

The conference aims at bringing together scientists and engineers dealing with fundamental and applied research for reporting on the latest results and achievements in the fields involved.

The conference is organized by the Technical University of Moldova in cooperation with the Academy of Sciences of Moldova, the Information Society Development Institute and the Information Technology and Cyber Security Service.

IC ECCO 2022 program consists of invited and contributed papers. The presentation should not exceed 15 minutes (contributed papers) and 30 minutes (plenary papers). The program is organized into tracks of related subjects. The official language of the conference is English.

The organizers will send an invitation for online meetings based on MS Teams. Each track will have its channel, and each topic will be realized in a separate meeting. All meetings will be created by organizers.

In 1967, the Faculty of Electrophysics, the forerunner of the "Computers, Informatics and Microelectronics" and "Electronics and Telecommunications" faculties, was founded. Hence all our friends are welcome in this conference edition to celebrate our 55th anniversary.

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TOPIC SPONSORS

CONFERENCE TRACKS

	Track 1	Track 2	Track 3	Track 4
Venues	A2	3-3	A4	A1
DAY 1 - 20 October	Plenary talks (Tekwill)			
	Biomedical engineering	**Software engineering and Cybersecurity**		**Management&Marketing and ICT**
DAY 2 - 21 October	Electronics	**Computer science**	Computer Engineering Communications	**Knowledge-based society**
	24 Speakers	*23 Speakers*	*9 Speakers*	*14 Speakers*

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OPENING CEREMONY

Tekwill ICT Excellence Center, IMAGINARIUM – Studenţilor str. 9/11

09:00	**Speaker**	*08:00 - Registration*	**OPENING CEREMONY**
	Viorel Bostan	Rector, Technical University of Moldova, *professor, dr. hab.*	
	Iurie Țurcanu	Deputy Prime Minister for Digitization	
	Ion Tighineanu	President Academy of Sciences of Moldova, *acad., professor, dr. hab.*	
	Mihai Dimian	Vice-Rector, *Stefan cel Mare* University of Suceava, Romania, *professor, dr. hab.*	
	Gheorghe Pantaz	Director, Information Technology and Cybersecurity Service	
	Alexandru Ciubuc	Chief Executive Officer, Moldtelecom	
	Evghenii Galamaga	Director Reprezentative in Moldova, Allied Testing	

VENUES

Tekwill, Studenților 9/11 Imaginarium

TUM, Studenților 9/7, Building nr. 3, FCIM

PLENARY SESSION

DAY 1

Session chairmen

20 OCTOBER 2022

prof., dr. hab., Oleg Lupan
assoc. prof., dr. Dumitru Ciorbă

	Speaker	PLENARY SESSION
09:30	Victor Șontea	Electrophysics faculty at 55th anniversary
10:00	Reiner Adelung	Porous materials for electrical gas sensors and actuators without moveable parts
10:30	*COFFEE BREAK*	
11:00	Mihai Dimian	Hybrid wireless vehicular communications and information technologies for vehicle safety and driver assistance
11:30	Ion Țurcanu	Enabling connected mobility via reliable and low-latency communication
12:00	Oleg Lupan	Nanosensors and Sensors Based on Heterostructured Materials for Safety and Biomedical Applications
12:30	Dorin-Mircea Popovici	Mixed Reality Technology in Support of Cultural Heritage

DAY 1: TRACK 1

HTTPS://ECCO.UTM.MD/ECCO22-TRACK1/   *Room A2*

BIOMEDICAL ENGINEERING

Domain

Biomaterials for medical applications; Biomedical instrumentation; Biomedical imaging and image processing; Medical physics and biophysics; Molecular, cellular and tissue engineering; Clinical engineering, health technology management and assessment; Health informatics, e-health and telemedicine; Biomedical engineering education; Innovation, development and interdisciplinary research; Nuclear and radiation safety and security.

Session chairman	**Program Committee members**
prof. dr. Victor Șontea	prof. dr. Călin Corciova (România)
assoc. prof. dr. hab. Artur Buzdugan	

	Speaker	BIOMEDICAL ENGINEERING
14:00	Anatolie Sidorenko	Spintronic Functional Nanostructures for Artificial Neural Network
14:15	Gheorghe Gorceag	Effective Management Of Medical Technologies For A Functional Health System
14:30	Victor Iapascurta	Dealing With Missing Continuous Biomedical Data: a Data Recovery Method for Machine Learning Purposes
14:45	Kostyantyn Kolisnyk	Features of Application of the Experimental Stand for Reception of the New Measuring Information Concerning Morphological Signs of An Erythrocyte
15:00	Ludmila Sidorenko	New Biophysical Approach in Analysis of Heart Rate Variability for Increasing its Predictive Value
15:15	*COFFEE BREAK*	

	Speaker	BIOMEDICAL ENGINEERING
15:30	Guy Attia	New Biotechnological Opportunities to Assess the Influence of Lifestyle Factors in Obesity
15:45	Anatolie Iacob Baciu	Arousal from sleep, alertness induced by bimodal signals during "environment-person" communication
16:00	Erez Arad	Recent Biotechnological Approach to Genetically Determined Atrial Fibrillation
16:15	Ilan Davidov	Biotechnological Tools in Genetics for Primary Prophylaxis of Essential Arterial Hypertension
16:45	Balabanov Anatolii	Information support of the processes of diagnosis and surgical treatment of chronic subdural hematoma of the brain

DAY 2: TRACK 1

HTTPS://ECCO.UTM.MD/ECCO22-TRACK1/　　　　　　*Room A2*

ELECTRONICS

Domain

Applied Electronics and Embedded Systems;
Micro & Nano-electronics

Session chairman

prof. dr. hab. Oleg Lupan

prof. dr. hab. HDR Thierry Pauporté (France)

Program Committee members

assoc. prof. dr. Serghei Railean

assoc. prof. dr. Tatiana Şestacova

	Speaker	ELECTRONICS
9:00	*Invited speaker* Alexander Vahl	Nanoparticle beam deposition methods for functional electronics
9:20	*Invited speaker* Stefan Schröder	Initiated chemical vapor deposition of tailored polymer thin films for electronic applications
9:40	*Invited speaker* Vardan Galstyan	Synthesis and chemical gas sensing properties of WO3 nanomaterials
10:00	*Invited speaker* Salih Veziroglu	Functional Metal Oxide Surfaces: Photocatalytic, Self-Cleaning, Sensing, and Micro-/Nanostructuring Applications
10:20	Cristian Lupan	The Reliability to Gamma Radiation of Gas Sensors Based on Nanostructured ZnO:Eu
10:35	Nicolae Secrieru	The evaluation of the on-board computer architecture for TUMnanoSAT series of nanosatellites for carrying out missions
11:00	*COFFEE BREAK*	

	Speaker	ELECTRONICS
11:30	*Invited speaker* Leonard Siebert	CuO-plate decorated ZnO nanostructures and their sensing performances
11:45	*Invited speaker* Jan Martin Wagner	Recent trends in solar cell development and characterization - an overview
12:00	Valentin Oleschuk	Algorithms of Overmodulation Regulation of Neutral Clamped Inverters for Photovoltaics
12:15	Vadimir Jdanov	Microprocessor Relay Protection LIRA Based on Amplitude-Phase Measurements of Signals
12:30	Valeri Verjbitki	The method of measuring the parameters of nanostructured sensors
12:45	Maria Lupu	Prospects Overview of the Superconducting Neural Networks
13:00	Vladimir Boian	Determination of the critical thickness of Nb superconducting layers coupled proximity with Co
13:15	Ion Avram	Active Filter on RC element with Distributed Parameters Sensitivity Analyze
13:30	Vitalie Secrieru	LED Grow Lights

DAY 1: TRACK 2

HTTPS://ECCO.UTM.MD/ECCO22-TRACK2/ *Lecture Hall 3-3*

Software Engineering and Cybersecurity

Domain

Methods and Tools of Software Engineering; Information Systems and Applications; Computer Security and Cryptography; Security and Privacy in Computing and Communications;

Session chairman
prof. dr. hab. Ion Bolun

Program Committee members
prof. dr. Panayotis Yannakopoulos (Greece)
prof. dr. Victor Beșliu

	Speaker	**SOFTWARE ENGINEERING AND CYBERSECURITY**
14:00	Ion Bolun	A Differentiated Beneficiary Cybersecurity Approach
14:20	*Invited speaker* Nistor Grozavu	Multi-modal multi-view emotion detection using non-negative matrix factorisation
14:40	*Invited speaker* Ferucio Laurentiu Tiplea	Privacy and Mutual Authentication under Temporary State Disclosure in RFID Systems
15:00	Alexandra-Ina Butnaru	Attribute-Based Encryption for Weighted Threshold Access Structures
15:15	*COFFEE BREAK*	
15:15	Victoria Bobicev	An Interface for Phonosemantic Assessment of Russian Words

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	Speaker	SOFTWARE ENGINEERING AND CYBERSECURITY
15:45	Ştefan-Gheorghe Pentiuc	Analysis with Unsupervised Learning Based Techniques of Load Factor Profiles and Hyperspectral Images
16:00	Nina Sava	State of water quality in the Prut River for the period of 2019-2021
16:15	Denisa-Ionela Țîflea	Vulnerabilities of LRSAS Protocol

	Speaker	COMPUTER SCIENCE
16:30	Vasile Moraru	A Method for Binary Quadratic Programming with circulant matrix
16:45	Daniela Istrati	A Brief Overview of Intelligent Interfaces in Production Systems

DAY 2: TRACK 2

Computer science

Domain

Mathematical Modelling and Applications; Algorithms and Computing Theory; Data Science/Engineering; Artificial Intelligence; Bioinformatics

Session chairman
prof. dr. Alexei Leahu

Program Committee members
prof. univ. dr. Radu-Daniel Vatavu (Romania)
assoc. prof. dr. Valeriy Fratavchan (Ukraine)
prof. dr. Vasile Moraru
assoc. prof. dr. Galina Marusic
assoc. prof. dr. Victoria Bobicev

	Speaker	**COMPUTER SCIENCE**
9:00	***Invited speaker*** Radu-Daniel Vatavu	Designing Interactive Computer Systems within the Framework of Sensorimotor Realities
9:20	***Invited speaker*** Serghei Mangul	Developing bioinformatics capacity in Moldova
9:40	Emilian Guțuleac	Performability Modeling of Self-Adaptive Systems Based on Extension Neural Rewriting Stochastic Petri Nets
9:55	Alexei Leahu	Graphical methods as a complements of analytical methods used in the research of dynamic models for networks reliability
10:10	Veaceslav Perju	Evaluation of the Multi-Algorithms Targets Recognition Systems

	Speaker	COMPUTER SCIENCE
10:25	Rares Radu	Comparing two security models for RFID
10:40	Valeriu Fratavcean	Pseudo Genetic Algorithm of Clustering For Linear and Ellipsoidal Clusters
11:00	*COFFEE BREAK*	
11:30	Ion Geru	Application of the Schwinger's oscillator model of angular momentum to quantum computing
11:45	Mario Lefebvre	An Inverse Stochastic Optimal Control Problem
12:00	Maksym Zylevich	Reduction programming in a technological programming environment
12:15	Andrei Enachi	Human Motion Recognition Using Artificial Intelligence Techniques
12:30	Alexandru-Ionuț Şiean	A Set of Smart Ring Gestures for Drone Control
12:45	Yaroslav Drin`	The first boundary value problem for the nonlinear equation of heat conduction with deviation of the argument
13:00	Victor Iapascurta	Kolmogorov-Chaitin Algorithmic Complexity for EEG Analysis

DAY 2: TRACK 3

HTTPS://ECCO.UTM.MD/ECCO22-TRACK3/   *Room A4*

**Computer engineering
Networks and Communications**

Domain

Automatic Control; Robotics; Computer design;

Telecommunications: Technology, Networks and Software; Electronics and Telecommunications: Operations, Administration and Maintenance; IoT Technologies: Software, Hardware and Connectivity; IT infrastructure and Cloud Computing

Session chairwoman
assoc. prof. dr. Viorica Sudacevschi

Program Committee members
prof. dr. hab. Emilian Guțuleac (Moldova),
prof. univ. dr. Ștefan-Gheorghe Pentiuc (România)
assoc. prof. dr. Ion Fiodorov,
lect. dr. Andrei Dorogan (Moldova),
prof. dr. ing. Dan Laurentiu Milici (România)

	Speaker	COMPUTER ENGINEERING
9:00	**_Invited speaker_** Mihail Iacob	The choice of DVB-T2 signal transmission technology in the shadow areas of the Republic of Moldova
9:20	Irina Cojuhari	The PID Tuning Procedure for Performance Optimization of the Underdamped Second-Order Processes
9:40	Adrian Secrieru	Tuning the PID Controller to the Object Model with Second-Order Inertia with Identical Elements and Time Delay by the Modified Polynomial Method

	Speaker	COMPUTER ENGINEERING
10:00	Tatiana Sestacova	Analysis of code sequences for multichannel data transmission systems
10:20	Vladimir Melnic	Tuning the Fuzzy Controller for Speed Control of the DC Motor
11:00	*COFFEE BREAK*	
11:30	Viorel Cărbune	Design of Specialized Hardware Architectures for Industry 4.0
11:45	Silvia Munteanu	Multi-Objective Optimal Solution Search based on Genetic Algorithms
12:00	Andrei Dorogan	Smart Lift – Intelligent lift service system
12:15	Ana Țurcan	Decision Making System based on Collaborative Agents

DAY 1: TRACK 4

HTTPS://ECCO.UTM.MD/ECCO22-TRACK4/   *Room A1*

Management&Marketing and ICT

Domain

Management and Marketing in the ICT; ICT in the Management and Marketing; eGovernment and Society; Digital economy.

Session chairwoman   **Program Committee members**
assoc. prof. dr. Lilia Sava   prof. dr. Gabriel Brăticu (România)
                                          prof. dr. hab. Victoria Ganea

	Speaker	MANAGEMENT&MARKETING AND ICT
14:00	Dinu Țurcanu	Website performance analysis in relation to the Visibility indicator of the Webometrics ranking: case study TOP 5 universities from the Republic of Moldova & Romania
14:20	Rodica Siminiuc	Role of the University Management System in the digitalization of Technical University of Moldova
14:40	Lilia Sava	Activation of attraction processes of investments into national economy through capital market
14:55	Valentina Tîrşu	Microfinance organizations under conditions of crisis and uncertainty
15:15	*COFFEE BREAK*	

DAY 1: TRACK 4

HTTPS://ECCO.UTM.MD/ECCO22-TRACK4/   *Room A1*

DIGITAL TOOLS FOR A COMPETITIVE ECONOMY

WORKSHOP

The *Digital Tools For A Competitive Economy* aims to initiate how information and communication technologies can be used as advantageous and timely sources for economic and social development.

Session chairwoman
assoc. prof. dr. Lilia Sava

15:45	*Special guests*	DIGITAL TOOLS FOR A COMPETITIVE
	Larisa Dunai (Spain) Constantin Roșioru	Globalization and technological change - are the basis of a new world economy "driven by technology, fueled by information and driven by knowledge. Such workshops are proposed to discuss solutions for process automation, improving business tools, facilitating the use of e-commerce and sales tools, comes to support innovative thinking, and creating useful services and digital products for many industries.

DAY 2: TRACK 4

HTTPS://ECCO.UTM.MD/ECCO22-TRACK4/   *Room A1*

Knowledge-based society

Domain

Research and Education for Knowledge-based Society; E-didactics & education methods based on ICT

Session chairwoman	**Program Committee members**
assoc. prof. dr. Natalia Burlacu	assoc. prof., dr. Ecaterina Lozovanu
	assoc. prof. dr. Mihai Braga

	Speaker	**KNOWLEDGE-BASED SOCIETY**
9:00	Natalia Burlacu	EdTech: Concept and Connections
9:30	Viorica Sudacevschi	Implementation of dual education at Technical University of Moldova
10:00	Ecaterina Lozovanu	Comprehension, Possibility and Death. The Justification of the Ontological Understanding of Death
10:30	Maria Guțu	Improving the Informatics Competencies Through Assessment for Learning
11:00	*COFFEE BREAK*	
11:30	Elena Gogoi	Exploring PBL as a New Learning Context in Engineering Education
11:50	Leon Brânzan	Non-linguistic Thinking as an Effective Tool for Innovation in Education
12:10	Dina Barcari	Digitalization of religion as a reaction to the pandemic crisis
12:35	Lidia Sabău	The impact of the COVID-19 pandemic on the financial education of primary school students

PLENARY SESSION

Abstracts

Porous materials for electrical gas sensors and actuators without moveable parts

Rainer Adelung[1]

[1] Chair for functional nanomaterials, Kiel University, ra@tf.uni-kiel.de, www.tf.uni-kiel.de/matwis/fnano/de

Sensors and actuators that do not require additional converters must be able to be read out and set electrically. This enables optimal connection to the readout, adjustment and control electronics. Gas sensors sand actuators can be used directly in microfluidic chips as elementary building blocks. Microfluidics is concerned with the behavior of liquids and gases in very small spaces. This talk briefly summarizes the work of our group over the last decade, showing how highly porous materials can be used as both electrical sensors and electrical actuators without the need for moving parts. This is because both applications ultimately require flow through electrically conductive material, for which highly porous materials are ideally suited. Highly porous structures from the aeromaterial family proved to be ideally suited for both gas sensors and actuators. Aerographite was first described in 2012. The material is based on a template consisting of interpenetrating microscale tetrapoal ZnO crystals. The template, which can be shaped to the desired geometry at the macroscale, is fabricated by gently pressing the tetrapodal powder and then sintering it. The tetrapodal shape as basic blocks guarantees a high free volume between the blocks. In further steps, a desired nanomaterial, e.g. graphene, in the case of Aerographite graphite, but as well carbon nanotubes, layered materials like h-

BN, etc., are first wrapped around the surface as a deposited thin film (wet chemical or CVD) and the underlying ZnO tetrapods are detached either by wet chemical or hydrogen gas etching. The resulting structure consists of an interconnected microscopic tubular network of macroscopic extent with wall thickness on the order of thin films, i.e., a few nanometers. These open structures are ideal for gas sensors. Surface effects dominate and enable high sensitivity and selectivity, both with and without the underlying zinc oxide template. Actuation can be accomplished by resistive heating of the aeromaterial. The usual resistive heating is associated with either slow heating or low volume effects. In this case, neither applies. The actuator responds in milliseconds, moves volumes up to four times its volumetric expansion, and is capable of carrying high loads, at least 10,000 times its own weight [8]. This is due to the negligible mass of the aermaterial, which results in negligible heat capacity of the material. The 3d structure with the high open porosity provides homogeneous heating of the gas trapped in the material between the tubes and leads to rapid volume expansion or presure increase. In addition, the talk will provide application examples that go beyond microfluidics.

Hybrid Wireless Vehicular Communications and Information Technologies for Vehicle Safety and Driver Assistance

Mihai Dimian[1]**, Alin Căilean**[1,2]**, Eduard Zadobrischi**[1,3]**, Lucian Cosovanu**[1]**, Cătălin Beguni**[1]**, Sevastian Avătămăniţei**[1]

[1]Ştefan cel Mare University of Suceava, Romania, dimian@usm.ro
[2]University of Paris-Saclay, France
[3]Technical University of Cluj Napoca, Romania

This presentation follows the main challenges and research directions in the area of hybrid wireless vehicular communications and the progress made in our research group in developing wireless communication systems for vehicle-to-vehicle and infrastructure-to-vehicle communications, as well as information technologies for vehicle safety and driver assistance. In the context of energy crises and the large number of car accidents, energy efficiency and traffic safety became the main research focus for automotive industry and public transportation administration. The use of wireless communications and information technologies for vehicular applications has a significant potential to address these global challenges. For example, a new safety standard proposal to mandate vehicle-to-vehicle communications for new cars was announced by USA Department of Transportation with the scope of stimulating automotive industry to develop communication and information technologies with applications in improving vehicle safety and energy efficiency.

Enabling connected mobility via reliable and low-latency communication

Ion Țurcanu[1]

[1] Luxembourg Institute of Science and Technology,
ion.turcanu@list.lu

In an increasingly connected world, cooperation among and between people and devices is key to boost innovation, to improve quality of life, and to build a sustainable society. In this context, wireless technologies revolutionized the way in which people and devices interact, providing connectivity on the move and enabling novel cooperative services with stringent communication requirements. A prominent example of such service is Cooperative, Connected and Automated Mobility (CCAM), which has the potential to substantially increase the safety and the efficiency of future transportation systems. Recent advances in wireless networking, which are delivering increased speed and higher reliability, are opening opportunities for novel CCAM use cases based on real-time sensor information shared among connected and automated vehicles. Technologies and standards in the IEEE 802.11 and 5G ecosystems are being developed to address the stringent communication requirements of CCAM applications.

At the same time, modern vehicles integrate hundreds of embedded devices forming complex wired on-board networks. Many of these on-board networked systems are successfully fulfilling stringent system and communication requirements, such as deterministic and very low end-to-end

latency and jitter, zero packet loss due to congestion, and tight synchronization between data producer and consumer. These requirements are addressed by ongoing standardization efforts, such as the ones developed by the IEEE Time-Sensitive Networking (TSN) task group.

In this talk we explore the main technologies enabling future CCAM services and applications. In particular, we describe the main standards, recent advances, and open challenges of wireless Vehicle-to-Everything (V2X) communications and wired intra-vehicle networked systems. We also discuss the main challenges that such isolated wired on-board networks face when opportunistically exposed to other similar networked systems via a wireless interface in a highly dynamic manner. Finally, we discuss the potentials of mixing TSN wired networks and best-effort wireless networks for V2X.

Nanosensors and Sensors Based on Heterostructured Materials for Safety and Biomedical Applications

Oleg Lupan[1,2,3,4]**, Thierry Pauporté**[3]**, Sandra Hansen**[2]**, Rainer Adelung**[2]

[1]Technical University of Moldova, National Center of Biomedical Engineering,
oleg.lupan@mib.utm.md
[2] Functional Nanomaterials, Faculty of Engineering, Germany
[3]PSL Université, Chimie ParisTech, Institut de Recherche de Chimie Paris,France
[4]Department of Physics, University of Central Florida, USA

The development of multifunctional nanosensors based on advanced nanomaterials is in the focus of the scientific and engineering community today, as it is one of the largest and fastest growing market segments. Scientific research on heterostructured micro- and nano-materials contributes to the miniaturization and performance improvement of existing solid-state sensors and light/image detectors, which are key components of many electronic, optoelectronic, safety, and biomedical circuits. Multitasking nanosensors are in high demand for small-sized smart wearable devices (e.g., smartphones with environmental, safety, or biomedical sensors) and other applications (from high-capacity information storage to biochemical sensing, analysis chemical and biological, etc.) due to reduced power consumption and improved performance. The challenges of using the properties of semiconducting oxides for practical application will be discussed and strategies for the fabrication, characterization, and integration of nanodevices through new technologies will be outlined. The integration and applications of

the single nanowire as sensing devices and, in particular, as multifunctional nanosensors are in demand too. In addition, the contribution of crystalline nanosensor and nanophotonic systems will be highlighted to act as an enabling technology for scientific achievements in other research areas. In this talk, nano-heterostructured semiconductor oxides as core nano-building blocks for nanodevices, namely our contribution to building a new route to nanodevices through top-down and bottom-up approaches to hybrid nanotechnologies will be discussed based on our research and comparison with current scientific literature

Mixed Reality Technology in Support of Cultural Heritage

Dorin-Mircea Popovici[1]

[1]CERVA, Ovidius University of Constanta, Romania,
mircea.popovici@univ-ovidius.ro

Facing the challenges that the Covid 19 pandemic imposed on all of us, i.e., maintaining a safe social distance or avoiding direct physical contact, we designed and implemented a VR-oriented solution that allows the users to experience free navigation and interaction with large and/or small replicas of cultural heritage artifacts, using simple hand gestures, with no touch. Chosing a point/artifact of interest, navigating to it and even exploring it, all these are possible in the open solution, for groups of tourists that visited the Archaeology Museum from Mangalia, Romania.

BIOMEDICAL ENGINEERING

Abstracts

Spintronic Functional Nanostructures for Artificial Neural Network

Maria Lupu[1], Nikolai Klenov[2], Igor Soloviev[2], Sergey Bakurskiy[2], Vladimir Boian[1], Cezar Casian Malcoci[1], Andrei Prepelita[1]¸ Evgheni Antropov[1]¸ Roman Morari[1], Anatolie Sidorenko[1,2*]

[1] D.GHITU Institute of Electronic Engineering and Nanotechnologies, Technical University of Moldova¸ Chisinau, 2028 Moldova;

[2]M.V. Lomonosov Moscow State University, Skobeltsyn Institute of Nuclear Physics, Moscow, 119991 Russia;

Energy consumption reduction becomes a crucial parameter constraining the advance of supercomputers. The non-von Neumann architectures, first of all – the Artificial Neural Networks (ANN) based on superconducting spintronic elements, seems to be the most promising solution. Superconducting ANN needs elaboration of two main elements – nonlinear one (neuron) [1] and linear connecting element (synapse) [2]. Results of our theoretical and experimental study of the proximity effect in a stack-like superconductor/ferromagnet (S/F) superlattice with Co- ferromagnetic layers of different thicknesses and coercive fields, and Nb-superconducting layers of constant thickness equal to coherence length of niobium are presented.

Superconducting spin-valves and superconducting synapse, based on layered hybrid S/F nanostructures was designed and investigated.

The layered nanostructures Nb/Co demonstrate change of the superconducting order parameter in thin s-films due to switching from the parallel

to the antiparallel alignment of neighboring F-layers. We argue that such superlattices can be used as tunable kinetic inductors for ANN synapses design.

Effective Management Of Medical Technologies For A Functional Health System

Gheorghe Gorceag[1]**, Victor Sontea**[2]**, Artur Buzdugan**[3]

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Medical devices are indispensable in performing the medical services, and their importance has become a priority at the institutional level as well as at the national level. In order to assure the proper functioning of the health system, it is necessary to provide medical devices, in accordance with the latest progress of medical technologies. However, qualified human resources and the implementation of effective management are vital for qualitative, safe, and efficient medical devices.

Dealing With Missing Continuous Biomedical Data: a Data Recovery Method for Machine Learning Purposes

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There are different approaches to dealing with missing data. A common one is by deleting observations containing such data, but it is not applicable when the volume of the data is limited. In this case, a number of methods can be applied, such as Last Observation Carried Forward and the like. But these methods are not suitable when all data for a certain parameter are missing. This paper describes a possibility of addressing this issue in the case of time series of biomedical data. Behind the method is the idea of the human body as a complex system in which various parameters are correlated and missing data can be inferred from the available data using the estimated correlation. For this, machine-learning-based linear regression models are built and used to recover data describing the sepsis state. Finally, recovered data are used to create a sepsis prediction system.

Features of Application of the Experimental Stand for Reception of the New Measuring Information Concerning Morphological Signs of An Erythrocyte

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During the research work to increase the resolution of three-dimensional image of erythrocytes to determine morphological parameters, the Laboratory of Biomedical Electronics of NTU KhPI developed and manufactured an experimental stand with better characteristics. The peculiarities of using an experimental stand for obtaining new measuring information on morphological features of erythrocytes, its design and methods of use, which allows obtaining new measuring information on geometric and morphological features of erythrocytes, with its further use to obtain new laboratory clinical features and improve diagnosing the relevant pathological processes of the patient's body.

New Biophysical Approach in Analysis of Heart Rate Variability for Increasing its Predictive Value

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Regarding the high incidence of cardiovascular diseases, it is critical to find predictors. The aim of this study is to appreciate the predictive value of recently-found parameters of cardiorhythmogram analysis applying the new biophysical approach for predicting the recurrence of atrial fibrillation. Material and methods. This is a case-series study, where 350 cardiorhythmograms were assessed. For assessment both methods were applied, the standard heart rate variability analysis and new approach by the parameters HF counter regulation and LF drops. Results. The both newly-found parameters predict reliably atrial fibrillation recurrence. The significance of the parameter HF counter regulation is $p < 0.0001$, in case of the parameter LF drops it is $p < 0.001$. Conclusions. In case if prediction is needed, the standard heart rate variability should be completed by the new biophysical approach, applying the parameters HF counter regulation and LF drops. Steady-state cardiorhythmograms with events of unstationarity can be realizably analyzed just by these parameters. Events of unstationarity are informative sources for prediction.

New Biotechnological Opportunities to Assess the Influence of Lifestyle Factors in Obesity

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Obesity results from a malfunction of the body's weight-control mechanisms, which may be influenced by environmental changes. Essentially, the obesity risk relies on two significant interdependent factors: genetic variations (single-nucleotide polymorphisms, haplotypes) and environmental risk exposure. Due to new biotechnologies over 127 potential genes for obesity have been identified, and evidence supports the function of 22 genes in at least five distinct groups. Gene and environment interactions mean that the synergy between genotype and environment is either additive or multiplicative. The application of innovative methods for both genotype and lifestyle variables should be emphasized.

Aim of study: Investigate variable data of lifestyle factors in obese people with genetic predisposition and without in order to figure out the trigger risks which transform the predisposition into obesity.

Material and methods: This is a descriptive study. A questionnaire was elaborated. It was developed based on the data of new biotechnological analysis of metabolic changes in obese humans. 142 individuals were included. 82 obese individuals, 42 with genetic predisposition and 40 without, and 60

healthy probands were interviewed. Further followed a comparative statistical analysis. Results: Obese probands were found with higher levels of disability compare those without, cardiovascular events higher compared with healthy probnads, disability level and smoking habits had significantly correlation in obese with genetic predisposition. On the other hand, health probands were found in higher level of anxiety compared obese people with genetic predisposition.

Arousal from sleep, alertness induced by bimodal signals during "environment-person" communication

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An attempt to carry out a conceptual synthesis based on reviewed data and conduct experimental testing of the effects of bimodal signaling in the "environment-person" communication. It is emphasized that. The environment has a very important role in the process of evolution of living beings, which, in turn, are a factor in the transformation of the environment. Bi- or multimodal signaling in the course of "environment-person" communication may be the most suitable neuromodulator and trigger of adaptive plastic remodeling in the control nerve centers.

Recent Biotechnological Approach to Genetically Determined Atrial Fibrillation

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The most prevalent persistent arrhythmia in cardiology is atrial fibrillation. Former atrial fibrillation which appears without any underlying reason was called „lone atrial fibrillation". Due to new biotechnological methods in electrophysiology, like mapping, unusual conducting mechanisms were stabilized. Due to new biotechnological methods of DNA analysis recently the reason is detected. This is a genetically determined atrial fibrillation. The aim of this study is to analyses what are the most common mutations which lead to atrial fibrillation. Material and methods. This is a systematic review study. The sources of information which were analyzed are mostly from google scholar and web of science. From 2000 sources, several sources were filtered out by the keywords and remained 14 sources on which is based this review study. Results. More than 70 genes are recently detected which lead to atrial fibrillations. Majority of them are mutations of the genes which encode the transport proteins of the heart s conductive system. The most common mutations that lead to genetically determined atrial fibrillation occure in KCNQ1, KCNA5 and 6q14–16. Conclusions. Before starting treatment of lone atrial fibrillation, a genetically test should be done in order to stabilize the type of the underlying mutation. This is a tactical step in taking the decision on treatment strategy by antiarrhythmic drugs or ablation. So ablatogenoics is the best solution for patients with genetically determined atrial fibrillation.

Biotechnological Tools in Genetics for Primary Prophylaxis of Essential Arterial Hypertension

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Hypertension is one of the most spread cardiological diseases, due to recent biotechnological tools it is discovered that arterial hypertension is a polygenic disease. Another possible explanation might be the variety of the studied populations. The current results of genetic analyses of essential hypertension highlight the need for a more differentiated approach to the understanding of complex, polygenetic traits that implements gene-gene- and gene-environment interactions or differentiated functional testing of thoroughly phenotyped cohorts under standardised environmental conditions. The advancement of molecular genetics now permits the establishment of a connection between high blood pressure and certain traits. The aim of this work is to analyse how genetic testing for primary prophylaxis of arterial hypertension can be applied.

Information support of the processes of diagnosis and surgical treatment of chronic subdural hematoma of the brain

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The study relates to the field of automation and information support of the processes of diagnostics and surgical treatment in neurosurgery. On the basis of complex software (BCS), computing and information systems of local corporate information networks of neurosurgical clinics are used, the initial data of standardized diagnostic protocols for clinical and instrumental studies of the brain of neurosurgical patients are formed. The data necessary for modeling are obtained after performing computed tomography (CT) and / or Magnetic Resonance Imaging (MRI), converting an image of the DICOM-PACS (Digital Imaging and Communications in Medicine) format on the network or from standard media (CD-R, CD-RW , USB flash drives, etc.) to build a real-time 3D model of the current state of the operated chronic subdural hematoma of the brain(CSDH), directly during its surgical treatment, based on the current 3D model of the real object of treatment.

ELECTRONICS

Abstracts

Invited speaker

Nanoparticle beam deposition methods for functional electronics

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Owing to their high surface-to-volume ratio, their small size and the high number of intrinsic defects, nanoobjects such as nanoparticles exhibit properties that go beyond typical bulk materials. In particular, nanogranular systems with nanoparticles as their fundamental building units exhibit electronic and optical properties that differ from their atom-assembled counterparts. As such, nanoparticles are promising building units for applications in catalysis, optics and functional electronics.

In the field of sensors, noble metal nanoparticles are readily used to cover surfaces of semiconducting metal oxide micro- and nano-structures, which consequently tailors sensor properties such as sensitivity, selectivity and response times. On the other hand, in the context of memristive devices and neuromorphic hardware, noble metal (alloy) nanoparticles can be applied to localize and enhance the electrical field and realize highly localized resistive switching processes. In addition, such nanoparticles can act as functional building units for self-arranged networks, which are poised at the threshold of electrical percolation and show criticality and avalanche dynamics.

Common to all of the abovementioned applications is the high demand on a precise control over nanoparticle composition and deposition process. In this contribution, nanoparticle beam deposition via a Haberland-type gas aggregation cluster source will be showcased as a versatile method that meets these demands. Nanoparticle beam deposition methods based on gas phase synthesis of nanoparticles offer the benefit of a high purity, surfactant free deposition that is compatible with a broad range of substrates. The fundamental processes of nanoparticle formation and trapping inside gas aggregation sources are highly dynamic and require a better understanding.

This contribution highlights the importance of in-operando diagnostic methods for the development of a deeper understanding of the nanoparticle formation processes inside a gas aggregation source. The applicability of in-operando UV-vis and OES to control the functional properties of nanocomposite thin films will be demonstrated at the example of AgAu alloy nanoparticles with tuneable alloy composition. Furthermore it will be demonstrated how laser light scattering techniques can be applied to comprehend the dynamic trapping processes of nanoparticles inside the nanoparticle source, in particular under consideration of different gas inlet geometries.

Invited speaker

Initiated chemical vapor deposition of tailored polymer thin films for electronic applications

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Device miniaturization and the consequent need for new thin film materials on the nanoscale is a current trend in electronic devices in research as well as industrial production lines. The solvent-free, single-step initiated chemical vapor deposition (iCVD) process combines the advantages of CVD with organic chemistry and enables the fabrication of tailored polymer thin films on the nanoscale on complex geometries and large-area substrates. The talk presents results from fundamental studies on the process to advanced electronic devices. These range from sensors and generators to soft robotics. With the help of additional computational ab-initio approaches, the properties of the thin films can be tailored on the molecular scale. It turns out that the process provides new pathways for electronic applications requiring precise film thickness control and high film quality.

Invited speaker

Synthesis and chemical gas sensing properties of WO3 nanomaterials

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Nowadays, sensing systems have become a necessary part of our daily lives including healthcare and environmental safety. Semiconductor nanostructures are very promising materials for the fabrication of high-performance gas sensing devices owing to their unique physical, chemical and electronic properties. However, the improvement of their functionalities to satisfy the requirements of sensing technologies is a challenging issue. Herein, we report a novel synthesis method for the fabrication of WO3 nanostructures. We performed the synthesis of nanomaterials by the thermal treatment of tungsten thin films using sodium chloride and distilled water. We examined the effect of water, sodium chloride and water vapor on the growth of WO3 nanostructures. The morphological, compositional and structural analysis of prepared samples demonstrates that it is possible to prepare porous structures composed of WO3 nanoparticles in an aqueous solution of sodium chloride and under exposure to water vapor. The studies of the gas sensing properties of materials indicate that they have a highly selective

response to acetone. In the meantime, our investigations show that the monoclinic γ-WO3 structure is more reactive and selective to acetone compared to the orthorhombic β-WO3. This feature can be attributed to the catalytic activity and large dipole moment of monoclinic γ-WO3. Hence, we provide a new strategy for the preparation of WO3 nanomaterials based on eco-friendly methods and their application in health and environmental monitoring.

Invited speaker

Functional Metal Oxide Surfaces: Photocatalytic, Self-Cleaning, Sensing, and Micro-/Nanostructuring Applications

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Titanium oxide (TiO2) is one of the most used photocatalytic materials for various applications such as environmental remediation, (solar)water splitting, and self-cleaning due to its high activity, low cost, high chemical, and physical stability. However, the photocatalytic activity of TiO2 is limited by the wide energy of the bandgap, low quantum efficiency, and rapid recombination of photogenerated charge carriers (electrons and holes). During the last decades, numerous approaches, such as tailoring the morphology (nanoparticles, thin film, etc.), combining with metal, noble metal, and metal oxide micro/nanostructures, have been demonstrated to enhance the photocatalytic activity of TiO2. However, it is still a major challenge to find the best photocatalytic combination for specific applications. Recent studies have revealed that particle size plays a considerable role in the photocatalytic activity of TiO2. Reducing the particle size (increasing active surface area) indicates a higher photocatalytic activity. Nevertheless, the use of photocatalytic nanoparticles in continuous flow systems (such as water remediation, water splitting, etc.) has some practical limitations such as

reusing and splitting them up from the reaction media. Hence, the use of robust and stable thin film photocatalysts becomes more suitable rather than nanoparticle systems for practical applications. Nevertheless, thin films are restricted by low surface area in contrast to nanoparticles and they show extremely limited photocatalytic activity. Here we present some case studies on enhancing the photocatalytic performance of TiO2 thin film by modification with metallic and oxide nanostructures for practical applications such as water purification, self-cleaning, selective oil absorption, and organic molecule sensing.

The Reliability to Gamma Radiation of Gas Sensors Based on Nanostructured ZnO:Eu

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In this work it was investigated the reliability to ionizing radiation of Eu-doped ZnO nanostructured films functionalized with Pd. Morphological, sensorial and electrical properties of sensors were studied initially, after irradiation and after 6 months to observe the influence of irradiation.

The evaluation of the on-board computer architecture for TUMnanoSAT series of nanosatellites for carrying out missions

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In this paper, a brief overview of the nanosatellite on-board computer (OBC) functions will be described. The main advantages and disadvantages of the most common OBC architecture will be explained. A set of three different architecture variants for TUMnanoSAT series of CubeSat nanosatellites is proposed and described. A feature comparison is performed in order to highlight the improvements and advantages of the proposed on-board computer architecture designs over traditional CubeSat OBC architectures.

Invited speaker

CuO-plate decorated ZnO nanostructures and their sensing performances

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In this paper, we report on the gas sensing properties of mixed oxide Zn-Cu nanostructures obtained by self-organized chemical deposition are presented. The nanosensors are made from individual ZnO whiskers and are coated with CuO/Cu_2O. They exhibit selectivity towards H_2 and NH_3 over other tested gases. Measurements were made in the temperature range between 20 - 175 oC. In order to determine the crystalline phases of the studied nanostructures, XRD diffractogram was measured, and SEM images were obtained for the morphological analysis.

Invited speaker

Recent trends in solar cell development and characterization - an overview

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Sooner or later, the development of silicon solar cells with steadily increased efficiencies will encounter the "barrier" of the Shockley–Queisser limit; standard cells having efficiencies well beyond that can only be reached by tandem architectures. On the other hand, at the same time the cells continuously become cheaper, at least concerning the price per watt. Therefore, for solar cell companies to stay in the market, fundamentally new industrially feasible cell structures and manufacturing concepts are needed. In this talk I will review the relevant development efforts, considering the whole fabrication process from the ingot growth over the wafering to the cell-making. Also, extended requirements for quality checks are an issue, for which adapted characterization methods are needed; I will consider those as well.

Algorithms of Overmodulation Regulation of Neutral Clamped Inverters for Photovoltaics

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This manuscript presents results of study and research of synchronous adjustment in the overmodulation control zone of three neutral-clamped inverters (NCIs) of the specific configuration of three-phase grid-connected photovoltaic system. It has been proved, that the corresponding modification of techniques and algorithms of pulsewidth modulation (PWM) for control of NCIs, assure symmetry and advanced harmonic composition of inverter-side winding voltage of multi-winding power transformer, thereby helping to reduce losses in windings of the transformer, and to improve the efficiency of photovoltaic installations.

Microprocessor Relay Protection LIRA Based on Amplitude-Phase Measurements of Signals

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Microprocessor-based relay protection devices make it possible to effectively ensure the functioning of electrical infrastructure of high-voltage transmission lines and substations in the emergency conditions. This is achieved through the use of high-speed accident detection algorithms and the use of modern electronic components. It is proposed to use a simple and fast algorithm for making a decision about the occurrence of an accident in the line based on amplitude-phase measurements of current and voltage signals. The algorithm is implemented in the microprocessor protection in system LIRA.

The method of measuring the parameters of nanostructured sensors

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In this paper, the data obtained from the research on the development of methods for measuring the parameters of nanostructured sensors, which is based on the use of 2 amplifiers and 2 analog-digital converters for measuring the voltages at the reference voltage source and the voltage drop on the additional resistor, which eliminates the shunt effect of the resistance of the structures investigated by the resistance input of the amplifier.

Prospects Overview of the Superconducting Neural Networks

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The long-term efforts of many research groups have led to the fact that by now a large number of different "learning rules" and architectures of neural networks, their hardware implementations and methods of using neural networks to solve applied problems have been accumulated. These intellectual inventions exist in the form of a "technopark" of neural networks. Each network from the technopark has its own architecture, training rules and solves a certain set of tasks. Moreover, specialized high-speed devices can be created on its basis. There are several levels of alienation of a neural network from a universal computer: from network learning on a universal device and the use of rich possibilities in manipulating a task book, learning algorithms and modifying architecture, to complete alienation without learning and modification capabilities, only the functioning of a trained network.

Determination of the critical thickness of Nb superconducting layers coupled proximiti with Co

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Contemporary technological progress is achieving new results due to current needs in microelectronics, superconductivity and nanotechnology. An important feature of high-speed, low-power microelectronics is the spin valve, which is made up of superconducting nanoscale layers such as niobium and cobalt. These two orders superconductivity and ferromagnetism, which at first sight have diametrically opposite tangents and in the natural state are virtually never next to each other - due to the Larkin - Ovchinnikov - Fulde - Ferrell (LOFF) state, demonstrate quantum phenomena quite exciting for further development with applications in: computer technology, chemistry, biology, pharmacology, artificial intellect etc. In this context of ideas we present research on Nb/Co hybrid structures with superconducting properties and the determination of the critical thickness of the superconducting Nb layer in contact with Co.

Active Filter on RC element with Distributed Parameters Sensitivity Analyze

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This article presents the results of research of the stability of characteristics of the active filter on element with distributed parameters through the calculate the sensitivity of the Amplitude - Frequency Characteristic (AFC) of the filter on change the value of each element of the electronic circuit of active filter.

LED Grow Lights

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Lighting source based on 0.5W superluminescent light-emitting diodes. The destination of the light sources. The existing emission spectra, and the proposed one. The list of components, the modules used, the current prices on the domestic and foreign markets, the opportunities for assembling light emitters in the Republic of Moldova. The possibility of creating new jobs, reducing prices and increasing the reliability of light emitters.

SOFTWARE ENGINEERING AND CYBERSECURITY

Abstracts

A differentiated beneficiary cybersecurity approach

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The considerable losses caused by the low level of infospace's cybersecurity and the limited financial resources available imply the need to found effective ways to improve the implementation of measures counteracting cyber-attacks. First, some aspects regarding the situation in the field are characterized, including: industries most targeted by cyber-attacks, common types of cyber-attacks, industries' readiness to counteract cyber-attacks, and causes of cybersecurity breaches. Reducing the costs with cyber-securing the beneficiaries may be achieved by typifying the solutions. For this purpose, criteria are selected and categories of beneficiaries are defined. Then the necessary actions for the differentiated cybersecurity (by categories) of beneficiaries are formulated.

Invited speaker

Multi-modal multi-view emotion detection using non-negative matrix factorisation

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Through this work we explore the unsupervised topological learning of multimodal data presenting a complex structure allowing to learn their representations. We are particularly interested in heterogeneous data whose representation may have been informed in different ways: expert representation which may be complex. Most classical machine learning and statistical inference systems dedicated to multimodal and/or complex data, whether they are based on random models, empirical measures or prototype-based models, rely on a strong hypothesis, consisting in supposing at least that the structure of the data generating process for the observed scene is fixed, though it can be supposed unknown. In an unsupervised context, some existed works on Ensemble and Collaborative machine learning approaches were proposed but are limited to the same data distribution, i.e. in a multi-view context.

Non-negative Matrix Factorization (NMF) is a data mining technique that splits data matrices by imposing restrictions on the elements' non-

negativity into two matrices: one representing the data partitions and the other to represent the cluster prototypes of the data set. This method has attracted a lot of attention and is used in a wide range of applications, including text mining, clustering, language modeling, music transcription, and neuroscience (gene separation). The interpretation of the generated matrices is made simpler by the absence of negative values. In this work, we propose a study on multi-modal clustering algorithms and present a multi-modal multi-view non-negative matrix factorization, in which we analyze the collaboration of several local NMF models.

The validation of the proposed approach is done on fusion of several emotion detection models covering multiple modalities: visual, acoustic and textual based on a dual-layered attention architecture.

The obtained results will be also presented on a demonstration starting by downloading video from YouTube. From the video we extract the audio track and the transcription for processing using and finally, as far as the visual aspect is concerned, we use two approaches, the first being based on "MediaPipe" if the trained model requires input markers, otherwise we extract directly from the video the images containing a well-framed face and clear. After-that the proposed multi-modal Non-negative matrix factorisation method is used for emotional detection.

Invited speaker

Privacy and mutual authentication under temporary state disclosure in RFID Systems

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Privacy and mutual authentication are two significant requirements for real-life applications of RFID schemes. These two requirements have been studied for a long time only for adversaries that cannot corrupt the temporary internal state of the tags. Recently, however, it has been shown that corrupting the temporary internal state of the tag is practically possible. This raises the question: do the current RFID protocols that ensure mutual authentication and privacy keep these properties in the temporary state disclosure model? The answer is negative and thus it justifies the effort to propose new RFID protocols that are secure under temporary state disclosure. In this paper, we amply discuss how temporary state disclosure affects mutual authentication and privacy of RFID protocols, and illustrate this on two well-known protocols. We argue then in favor of using the PUF technology in order to achieve mutual authentication and a reasonable enough level of privacy under temporary state disclosure. We close by presenting two RFID schemes that achieve destructive privacy, one of the most important levels of privacy in the context of the physical corruption of tags.

Attribute-Based Encryption for Weighted Threshold Access Structures

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Access control is a fundamental security component in a system, especially in rapidly developing domains such as the cloud or the Internet of Things. The nature of these domains renders formerly acclaimed access control techniques inefficient in environments that are distributed and need highly scalable solutions. Attribute-based access control offers a multitude of advantages, especially through its cryptographic implementation, attribute-based encryption. Weighted threshold access structures are structures that closely cover real-life scenarios and have high applicability in practice as access control policies.

An interface for phonosemantic assessment of russian words

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This paper describes an interface for the phonosemantic evaluation for Russian words. By phonosemantics we mean the subconscious emotional interpretation of the acoustic perception of words independent of their meaning. The given method is based on data about the emotional perception of sounds, obtained from a sample of respondents. The developed program evaluates the emotional characteristics of the words using data about the sounds. The interface allows users to evaluate phonosemantics for a given word as well as to introduce her/his personal perception of phonosemantics for individual sounds of Russian language.

Analysis with Unsupervised Learning Based Techniques of Load Factor Profiles and Hyperspectral Images

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The problem of obtaining an optimal partition consistent with a series of partitions resulting from the application of various clustering algorithms is NP complete. A heuristic method based on the concepts of central partition and strong patterns developed by Edwin Diday [3] is proposed. It is presented the experience regarding the use of analysis techniques based on unsupervised learning methods of load factor profiles and hyperspectral images.

State of water quality in the Prut River for the period of 2019-2021

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The paper addresses the issue of water quality of the Prut River between 2019 and 2021. The data on pollution of the Prut River and its tributaries are analyzed. The negative influence of detected pollutants on human health is discussed. The statistical analysis of the data is performed through the help of statistical methods using the R language. The obtained results are presented. As a result, it is proposed to develop prediction scenarios exceptional situations of water pollution.

Vulnerabilities of LRSAS Protocol

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The construction of secure and private RFID protocols is necessary with the increasing application of RFID technology in increasingly diverse fields. While security refers to unilateral or mutual authentication depending on the protocol, privacy is a more elaborate concept to which many studies and research have been dedicated. Unfortunately, many RFID protocols are still being developed without consistent security and privacy analysis in well-defined models, such as the Vaudenay model. In this paper, we aim to prove that a recently proposed authentication protocol, LRSAS, does not achieve any form of privacy in Vaudenays model.

COMPUTER SCIENCE

Abstracts

A Method for Binary Quadratic Programming with circulant matrix

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Binary quadratic programming is a classical combinatorial optimization problem that has many real-world applications. In this paper we present a method for solving the quadratic programming problem with circulant matrix by reformulating and relaxing it into a separable optimization problem. The proposed method determines local suboptimal solutions. To solve the relaxing problem, the DCA algorithm is proposed to calculate the solutions, in the general case, only local suboptimal.

A brief overview of intelligent interfaces in production systems

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This paper presents a state of the art in the field of intelligent user interfaces, which are the main element that make the interaction between the humans and machines in the most efficient, natural, affective way. As an interdisciplinary product, the design of user interfaces represents the combination of models from disciplines like software engineering, artificial intelligence, human-computer interaction and other disciplines (sociology, psychology, etc.). In the process of design and operation of production systems, an important factor is its responsiveness and the ability to have integrated the capacity to change over time and functionally. To achieve a high level of structural configuration and feasibility, it is necessary for a production system to have a compatible interface

Designing Interactive Computer Systems within the Framework of Sensorimotor Realities

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This keynote provides an overview of the new concept of Sensorimotor Realities (SRs) and exemplifies applications involving wearable and ambient devices.

Developing bioinformatics capacity in Moldova

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The field of bioinformatics and computational biology is one of the hottest scientific fields that has emerged and grown recently from traditional disciplines such as biostatistics, medical informatics, mathematics, informatics, molecular biology, and genetics. Since the universities of Moldova

have a historical strength and show enormous potential in these classic fields, until 2021, there were no research and higher education institutions in Moldova that incorporated the field of bioinformatics in their academic programs or hosted research groups or services in bioinformatics. Among the reasons for this we list the relative lack of research projects requiring computational biomedical data analysis, lack of local expertise, lack of necessary infrastructure, lack of adequate national financial support, and the resistance of many academic institutions to incorporating new areas of teaching and research. To maintain and increase the quality and pace of existing research in the life sciences, biotechnology, molecular engineering and medicine, a rapid and significant investment in bioinformatics was needed. In 2021, the first bioinformatics laboratory was created at Technical University of Moldova, then in 2022 at State University of Medicine and Pharmacy of the Republic of Moldova, both laboratories being supported by the host universities and partner laboratories outside the country. Within a year, the integration of local laboratories into international projects and consortia in various current topics in bioinformatics was achieved, and young researchers were involved in research teams in various projects in the USA and Europe. At the same time, bioinformatics training and schools have played an important role in creating skills and early placement of researchers and students in research problems and projects. As a result, the Republic of Moldova has unlocked its bioinformatics capabilities thanks to the efforts of

national universities and partners from abroad, managing to break out of academic isolation in the field of bioinformatics.

Performability modeling of self-adaptive systems based on extension neural rewriting stochastic Petri Nets

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Traditional mathematical formalisms are unable to model modern self-adaptive discrete event systems (ADES) because they cannot handle behaviors that change at run-time in response to environmental changes. This paper introduces a new extension of Reconfigurable Stoc-hastic reward Nets (*RSRN*), called Extension Neural Rewri-ting Petri Nets (ExNRPN), which enables the performability modeling and simulation of modern ADESs. ExNRPNs are obtained by incorporating in some special transitions of *RSRN*s an extension neural network (ENN) algorithm where the run-time calculation and reconfiguration is done in the local components, while the adaptation is performed for the whole system. The application of the proposed ExNRPN is illustrated by performability modeling a particular ADES.

Graphical methods as a complements of analytical methods used in the research of dynamic models for networks reliability

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Our work deals with a typical problem of comparing the reliability of a serial-parallel type network vs the reliability of a parallel-serial type network. Using graphic methods on elementary models, we show how they lead to the formulation of mathematically argued conclusions. These conclusions are then extended to whole families of probabilistic dynamic models related to the initial models.

Evaluation of the Multi-Algorithms Targets Recognition Systems

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There are presented the results of the evaluation of the new classes of the target recognition systems - multi algorithms unimodal systems and multi algorithms multimodal systems. There are described the structures and the graphs of the systems. It was made their mathematical descriptions and presented the formulas for evaluation of the systems' costs depending on the algorithms' recognition probability and the relation between the costs of the system's hardware and the algorithm's software. It was proposed the approach to determine the cost of a system for an established threshold level of the system's recognition probability. It was evaluated the relation of the system's cost to the system's recognition probability for different values of the algorithm's recognition probability. It was evaluated the rating of the target recognition systems based on their recognition probabilities and costs.

Comparing two security models for RFID

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Radio Frequency Identification Technology became more and more involved in authentication processes over the years and is still rising. Security in this context needs to be strongly ensured, hence security models have a crucial role motivated by the fact that any entity with the right tools can interfere or eavesdrop in the communication process between a tag and a reader. The two most relevant, complete and worth mentioning models at this hour are Serge Vaudenay's model based on the introduced 'blinder' notion and the HPVP model of J. Hermans, R. Peeters and B. Preenel's based on the left-or-right indistinguishability notion. We provide a comparison between these two models that highlights not only the differences and the similarities, but also the elements that make each model unique along with the tag corruption aspects and the different privacy levels achieved by each model regarding both symmetric and asymmetric cryptography.

Pseudo genetic algorithm of clustering for linear and ellipsoidal clusters

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This article considers the method of clustering in the problems of pattern recognition when studying with a teacher in the case of n-dimensional numerical features. Clusters of linear and ellipsoidal forms that are optimal in the number of errors are created by the method of pseudo genetic algorithm. The pseudo genetic algorithm has a simplified procedure for performing mutation and crossover operations.

Application of the Schwinger's oscillator model of angular momentum to quantum computing

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The Schwinger's oscillator model of angular momentum is applied to define quantum logical elements in quantum circuits by means of wave functions of two independent harmonic oscillators. It is shown how four EPR entangled states can be determined based on this model.

An inverse stochastic optimal control problem

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The problem of controlling a compound Poisson process until it leaves an interval is considered. In this paper, instead of choosing the density function of the jumps and trying to find the corresponding value function, from which the optimal control follows at once, we consider the inverse problem: we fix the value of the value function and we look for admissible density functions for the jumps.

Reduction programming in a technological programming environment

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This work is aimed at demonstrating, on a representative sample, the usefulness of programming concepts in the state of semantic patterns as relations in a program chain that specify particular types of programs. This is achieved via the use of program descriptors, which act as means of translating composites and basic functions of the technological programming system into their syntactic declarations at the last step of technological programming.

Human motion recognition using artificial intelligence techniques

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The goal of this paper's research is to develop learning methods that promote the automatic analysis and interpretation of human and mime-gestural movement from various perspectives and using various data sources images, video, depth, mocap data, audio, and inertial sensors, for example. Deep neural models are used as well as supervised classification and semi-supervised feature learning modeling temporal dependencies, and their effectiveness in a set of tasks that are fundamental, such as detection, classification, and parameter estimation, is demonstrated. as well as user verification.

A method for identifying and classifying human actions and gestures based on utilizing multi-dimensional and multi-modal deep learning from visual signals (for example, live stream, depth, and motion - based data). A training strategy that uses, first, individual modalities must be carefully initialized, followed by gradual fusion (called ModDrop) to learn correlations between modalities while preserving the uniqueness of each modality specific representation. In addition, the suggested ModDrop training approach assures that the classifier is detect weak inputs for one maybe more channels, enabling these to make valid predictions from any amount of data points accessible modalities. In this paper, inertial sensors (such as accelerometers and gyroscopes) embedded in mobile devices collect data.

A set of smart ring gestures for drone control

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We present in this paper the results of a frequency analysis of gesture commands frequently employed for human- drone interaction in the scientific literature, and we propose a set of gestures for controlling drones that can be performed with smart rings. Our method consists in the analysis of thirty-seven articles, which we examined closely to extract commands for human-drone interaction, including voice, gesture, and multi-modal input. Based on our meta-analysis, we present a set of six groups of commands for human-drone interaction together with a set of smart ring gestures to interact with and control drones. Our results can be used to inform the design of new interactive applications for controlling smart-ring drones.

The first boundary value problem for the nonlinear equation of heat conduction with deviation of the argument

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The initial-boundary problem for the heat conduction equation with the inversion of the argument are considered. The Green's function of considered problem are determined. The theorem about the Poisson integral limitation is proved. The theorem declared that the Poisson integral determine the solution of the first boundary problem considered and proved.

Kolmogorov-chaitin algorithmic complexity for EEG analysis

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Electroencephalography as a generally accepted method of monitoring the electrical activity of brain neurons is widely used both in diseases and in healthy conditions. The recorded electrical signal is usually obtained from several electrodes located on the scalp. While EEG recording techniques are largely standardized, the interpretation of some aspects is still an open question. There is a hardly questionable progress in detecting the abnormal EEG signals known as seizures.

A less explored field is the detection and classification of non-pathological conditions such as emotional and other functional states of the brain. This requires special approaches and techniques that have been widely developed over the past decade.

The current paper describes an attempt to use algorithmic complexity concepts and tools for EEG transformation making it possible to combine this approach and machine learning for classification purposes.

COMPUTER ENGINEERING

NETWORKS AND COMMUNICATIONS: INFRASTRUCTURE AND SECURITY

Abstracts

Invited speaker

The choice of DVB-T2 signal transmission technology in the shadow areas of the Republic of Moldova

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This article presents the results of research into the opportunity to use Gap Fillers in the shadow areas of the first national digital terrestrial television multiplex of the Republic of Moldova. A basic condition related to the expansion of the population's access to the DVB-T2 signal in the "shadow areas" was - the use of the existing terrestrial broadcasting infrastructure. It was demonstrated that, to achieve the proposed goal, the use of Gap Fillers is not appropriate, but for the signal emission in the "shadow areas" it is necessary to use low-power DVB-T2 transmitters. In this case, the transport of the T2-MI flow to the entrance of the mentioned transmitters will be ensured by means of the existing fiber optic networks.

The PID Tuning Procedure for Performance Optimization of the Underdamped Second-Order Processes

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In this work, it is proposed the procedure for tuning the PID controller to the underdamped second-order systems, that offers the possibility to optimize the performance of the system. The analytical expressions for calculation the tuning parameters of the PID controller were obtained according to the maximum stability degree criterion. These analytical expressions permit to calculate the tuning parameters according to the values of the damping ratio, natural frequency and transfer coefficient, that can be determinate from the step response of the underdamped system. The proposed procedure for performance optimization permits to optimize the value of rise time and percentage of overshoot. To demonstrate the efficiency of proposed method the computer simulation was performed.

Tuning the PID Controller to the Object Model with Second-Order Inertia with Identical Elements and Time Delay by the Modified Polynomial Method

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The paper presents the procedure for tuning the PID control algorithm to the object model with second-order inertia with identical elements and time delay according to the modified polynomial method. Methods that can be applied for tuning the PID control algorithm to this control object model are analyzed. The modified polynomial method of tuning the PID algorithm to the second-order inertial control object model with identical elements and time delay is developed, which presents as a simple procedure. To compare the obtained results, tuning methods are applied: the maximum stability degree method in analitycal form and with iterations, Ziegler-Nichols method and parametrical optimization of the PID controller to the model of the given object. The tuning algorithm according to the method of the maximum degree of stability with iterations and the modified polynomial method is synthesized for an example of the object model with second-order inertia with identical elements and time delay, and the results obtained for the variation of the object model parameters are analyzed. The advantages of the maximum stability degree methods with iterations and modified polynomial are highlighted.

Analysis of code sequences for multichannel data transmission systems

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A comprehensive indicator of the quality of information transmission systems under the influence of interference of natural or artificial origin is noise immunity. The paper presents the results of studies on improving the noise immunity of systems through the use of broadband or noise-like signals based on Walsh functions for information transmission.

Tuning the fuzzy controller for speed control of the DC motor

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In this paper, it is developed the fuzzy controller for speed control of the DC motor. The obtained results of tuning the controller were compared with maximum stability degree method with iterations and genetic algorithm. To verify the efficiency of the developed fuzzy controller the computer simulation was done. The algorithm of tuning the fuzzy controller was designed according to the error and the rate of change of the error signal, so that performance of the closed-loop step response to be satisfied.

Design of specialized hardware architectures for Industry 4.0

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In the process of transition to Industry 4.0, the importance of applying cutting-edge technologies such as machine learning and artificial intelligence to replace human operators in industrial processes is explained by the need to automate industrial production processes. Replacing qualified human experts with artificial neural networks opens up a lot of possibilities for the implementation of new methods of industrial process automation. The problem of industrial process automation is quite complex because the decision-making process of the human expert is accompanied by uncertainty. Artificial neural networks represent one of the basic branches of artificial intelligence. At the moment, they are used in various fields to solve problems for which classical methods are unable to provide practical solutions. Thus, the problem of developing and training artificial neural networks for solving industrial process automation problems acquires major importance in the design of artificial intelligence systems. The training process directly depends on the data set on the basis of which the neural network is designed.

Multi-objective optimal solution search based on genetic algorithms

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The paper presents the results of research carried out to solve complex problems aimed at the efficient use of natural and energy resources. The objectives of the paper are achieved by identifying the control process based on a Multi-Agent system with distributed data processing that implements a Multi-objective optimal solution search model based on the application of a Genetic Algorithm with Collective Computation. The set of Agents presents a computational architecture that forms a structured network topology based on a P-Systems model presented in the form of a Venn diagram. The Object diagram and the Venn diagram of the P-Systems model are presented in the paper. The correctness of the developed models was verified on the basis of a control system of the artificial lighting process that provides for the minimization of energy consumption, while ensuring the quality of the lighting process.

SMART LIFT – Intelligent lift service system

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The paper presents the results of the development of an intelligent lift service software system that allows the detection of people and their numbers on each floor, the recognition of persons by assigning a conventional identity, the prediction of the destination floor for each user using facial detection applications and data forecasting based on the history of lift usage statistics.

Decision Making System based on Collaborative Agents

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In this paper are presented the results of research done in the system projecting and research for making informed decisions based on the collaborative Agents. The mathematical model used in this research had the goal to find an optimal solution in a multi-objective space by using methods inspired by nature, especially evolutional calculus algorithms. The calculus system's architecture consists of two sets of Agents: agents that deliver data and information, and Agents that consume it. The interconnection process between Agents is a dynamic one which evolves in time and it determines the topology of the calculus system.

MANAGEMENT&MARKETING AND ICT

Abstracts

Website performance analysis in relation to the Visibility indicator of the Webometrics ranking: case study TOP 5 universities from the Republic of Moldova & Romania

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The Webometrics Ranking of World Universities periodically brings to the attention of mass media, but also to the society of the Republic of Moldova, information relevant for future students regarding the positions of higher education institutions in the country. A website is simply a prerequisite of online existence for a university. Most of the time, the university's webpage is the place where one can present detailed information about institution's activity, educational services provided, research activity, etc., this being the official source of information for future students, future graduates, but also university partners. The purpose of this paper is to analyze the webpages of the TOP 5 universities ranked by Webometrics from the Republic of Moldova and Romania, in terms of the visibility indicator of this university ranking. The paper has the task to make a comparative evaluation of the universities' webpages so that the conclusions formulated later could contribute to the improvement of the Moldovan universities' positions in the Impact Rank section of the Webometrics Ranking of World's Universities.

Role of the University Management System in the digitalization of Technical University of Moldova

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Digital transformation has radically transformed societies and economies, having an ever-increasing impact on everyday life. The COVID-19 pandemic has revealed certain challenges for education systems related to digital skills of the higher education institutions, the use of digital tools and general level of digital competences and digital literacy. Ideally, a University Management System should have several functionalities, such as: management of the professional guidance of students (prospective students), management of the admission process, student management, employee management, finance management, research management, graduate management, management of the university documents and processes, but also academic management. A successful university management system will ultimately ensure the quality of education, will maintain a high level of institution's image and academic integrity.

Activation of attraction processes of investments into national economy through capital market

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The globalization of the world economy and the integration of the Republic of Moldova into the European Community will require the state to create conditions for sustainable economic development, which is impossible without intensifying investment activity. The problem of attracting massive foreign investment requires improving the capital market in the country. The most important direction in solving this problem is the development of the internal stock market as the most efficient mechanism for redistributing financial resources. Therefore, the stock exchange should contribute at activation of attraction processes of investments in the national economy as a stimulus for future investment activity.

Microfinance organizations under conditions of crisis and uncertainty

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In conditions of deep global crisis, microfinance is considered to be one of the most adaptable financial instruments to the needs of small and medium-sized enterprises. This form of financial support for small enterprises in the form of microfinance organizations is highly relevant for the economy of the geographical region, the stability and scale of the activities of existing companies in this area. In this context, the authors, in addition to highlighting the momentary gaps in this segment of the economy activity, but also identify a number of proposals with regard to the management of credit risk and over-indebtedness risk, these are identified as the most urgent probable risks of the microfinance market, both in the Republic of Moldova and internationally.

KNOWLEDGE-BASED SOCIETY

Abstracts

EdTech: concept and connections

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The present article turns out to be theoretical research in the field of Educational Sciences with an emphasis on educational technologies widely used in general didactic; and also specific didactics as instruments of interaction with the learner; of diversification and customization of the teaching-learning-evaluation process, bringing an added value in the transfer of knowledge to the new generation of learners, digital natives.

The given paper includes the analysis of the scientific literature related to the EdTech theme; the presentation of the core domains in the development, and application of EdTech; the reflection on the typology of EdTech environments, as well as Hi-Tech components.

The author determines and describes the connections of the EdTech concept in the pedagogical, psychological, and technical context in this work, after which in the final phase he formulates recommendations regarding the possibilities of integrating and expanding EdTech in the educational process of local pre-university and university institutions. (Abstract).

Implementation of dual education
at Technical University of Moldova

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The article analyses the implementation of the dual study model for higher education at the Technical University of Moldova. This goal was one of the basic ones within the Erasmus+ COOPERA project "Integrating Dual Higher Education in Moldova and Ukraine". The development vision and needs of the national economy define the leading arguments for the pilot programs at the Technical University of Moldova. The faculty team proposes a Dual higher education model appropriate for students from two engineering programs. The model specifies the roles of the student, university and company in dual education and the benefits of all involved actors. In the designing phase of the project, the teaching staff consult students, company administrators and specialists to fit all interests into one joint model and curricula.

Comprehension, possibility and death. The justification of the ontological understanding of death

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If death is revealed to us, in our human experience, as a certainty, one of the decisive questions of explaining our human condition aims at questioning and justifying this certainty.

One of the authors who tackles this question is the German thinker, Martin Heidegger. According to him, death is understood and described, through a phenomenological and hermeneutical explanation, as an inner existential possibility as an ontological condition of the human being.

This understanding has received various criticisms from contemporary philosophers. One of these belongs to Bartrand Schumacher who sustains that the only ontological understanding of existence cannot provide a certainty of its own end. In this way, Schumacher opposes an ontic meaning to the Heideggerian ontological understanding of death.

In response to Schumacher's critics we propose to look more deeply at the concept of possibility as the key-concept in the Heidegger's ontological understanding of death.

Improving the informatics competencies
through assessment for learning

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This paper presents the impact of the assessment for learning on students' Informatics competencies. The paper has described the usage, advantages and disadvantages of the assessment for learning as self-assessment, peer assessment, and co-assessment. As a result, the survey method was applied to find out the students' opinions about the assessment for learning in general, and the self-assessment, peer assessment and co-assessment in particular.

Exploring PBL as a new learning context in engineering education

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This paper explores the experience of engineering students in an innovative context, namely, Problem-Based Learning (PBL). It first describes some particular details of PBL framework implementation at the BSc Degree in Software Engineering, an English-taught Honours Programme at the Faculty of Computers, Informatics, and Microelectronics, Technical University of Moldova. The research also addresses some specific aspects of students' preparation for collaboration, milestones, working process, guiding sessions, etc. A comparative study between 2021 and 2022 editions of BCs graduates in Software Engineering was conducted to identify the efficiency of several dimensions of this new learning environment.

Non-linguistic thinking as an effective tool for innovation in education

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In higher education subjects are traditionally taught in the form of lectures, where teachers are required by the curriculum to cover a certain amount of content in order to prepare their students for subsequent courses or examinations. It has been observed that people struggle when they are required to memorize a lot of new information, this phenomenon is explained by the working memory theory [1], and the negative effect is amplified when teaching subjects like programming, with the links between categories of information that has to be memorized not clearly identifiable by beginners. Lecture material for programming courses often mixes language-specific information (keywords, syntactical rules, ready solutions), mathematical basis for a given solution (type theory, algorithm theory), hardware-specific limitations (computer memory management) etc. This often has drastic consequences for students' success in later courses that rely on material from previous courses [2].

This paper argues, that the process of learning is not simply about transferring knowledge from teacher to student. In fact, knowledge does not have to be "existing in an objective manner" for subsequent transmission, it can also be "built in a constructive manner by the learner" [3]. Within a

traditional educational process software engineering students find themselves in situations where text is used to reason about other forms of text: typically code examples are shown first, then the code's structure and syntax are explained. While there is intrinsic value in reading code written by experts, reading explanations of that code is much less effective than trying to reason about the structure and function of a program, and various features of a programming language. This paper will attempt to showcase several teaching techniques that don't utilize textual explanations (either partially or completely), putting forward the argument that non-linguistic presentations can be more effective in teaching, under certain conditions. Several methods of achieving this effect will be described, with the main goal of appealing to the student's ability for computational thinking.

Digitalization of religion as a reaction to the pandemic crisis

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In this article we reflect on the changes produced once the pandemic began. Changes have also taken place in the ability of religious communities to adapt to the new requirements of communication with parishioners, one of which is the digitization of religion. Daniele Hervieu-Leger argued that religion rests on the authority of tradition and relies on an intergenerational transmission of the collective memory of that tradition. This does not mean that religion is static, nor that the fragmented nature of modernity is incompatible with religion. Modernity has not eliminated the individual's or society's need to believe. Indeed, it was observed that the uncertainty arising from the dynamics of change made the need stronger. The transmission of religious tradition is more difficult in the contemporary age, however, it would persist in different ways than before; religion retains a creative potential in modernity. The response of religion and religious people to Covid-19 gives us an opportunity to examine the digitization of religion in response to the pandemic crisis. It has been observed that society, like our need for tradition, has continued to adapt. This is evident through an examination of religion during Covid-19, where it appears that a large number of regular church attendees have switched to online religious attendance, especially during the lockdown period.

The impact of the COVID-19 pandemic on the financial education of primary school students

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The global COVID-19 pandemic of 2020 has exposed both the underdevelopment of education systems around the world and the level of financial literacy – both of the population and students. This aspect brought back to the fore the importance of using ICT in school, in the actual act of teaching financial education, as education systems were preparing for the transition to online education due to school closures. This critical research provides an overview of the challenges brought by the pandemic: the problems faced by teachers in schools in the form of online teaching, the fundamental change in teaching methods during the pandemic, and the adaptation that both teachers and students must adopt, alike. This article will also provide some recommendations for integrating digital technology into financial education learning environments in the post-pandemic era.

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