

2021 International Conference Automatics and Informatics (ICAI 2021)

**Varna, Bulgaria
30 September – 2 October 2021**



**IEEE Catalog Number: CFP21X63-POD
ISBN: 978-1-6654-2662-6**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP21X63-POD
ISBN (Print-On-Demand):	978-1-6654-2662-6
ISBN (Online):	978-1-6654-2661-9

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

CONTENTS

CONTROL THEORY

Multi-output identification and LQG control of a two-wheeled robot T.Slavov, P. Petkov, S. Sherif and J. Krlev	1
Gramians computation for hyperbolic distributed parameter systems K.Perev	8
Adaptive state controller with suspension of the recurrent estimation process N.Nikolov and M. Alexandrova	14
Nonlinear Model Predictive Control of the Depth of Hypnosis during Anesthesia in the Presence of Uncertainty A.Grancharova and I. Valkova.....	18
Study of fractal regulators B.Grasiani.....	23

CONTROL SYSTEMS

Information Modeling of Cyber-Physical Systems using OPC-UA T.Ivanova, I. Batchkova and D. Gocheva	27
Comparative analysis of control quality between PI and FUZZY controller of experimental electrohydraulic servosystem S.Yordanov, K. Ormandzhiev and G. Mihalev	32
A Self-Tuning Fuzzy PID Controller for SEPIC Based on Takagi-Sugeno Inference System E.Yusubov and L. Bakirova	38
Impulse Control of DC Motor with Addition of Energy S.Ivanov, Y. Ivanova and K. Peichev	42
An UKF-based Extremum Seeking Control of Two-Stage Anaerobic Digestion Process D.Xu, H. Wang, Y. Tian, N. Christov, L. Kabaivanova and I. Simeonov	46
Implemented PLC System Controlling the Air Purification in a Hospital, Operating With Radioactive Isotopes V.Vasilev and B. Aprahamian.....	52

DATA PROCESSING

Content-Based Image Retrieval: Impact of image resolution on the search accuracy and results ordering	
M.Marinov, Y. Kalmukov and I. Valova	56
Reducing the Estimation Error of the Measure of Proximity Between Objects in Pattern Recognition	
R.Mammadov, E. Rahimova and G. Mammadov	60
A Hybrid Model for Structuring, Storing and Processing Distributed Data on the Internet	
V.Hadzhev and A. Rashidov	66
Research of the optimization techniques applied to an integrating period meter	
S.Stoyanov, D. Mihaylova and Asparuh Atanasov	70
Study of the specifics of the spectral reflections of different varieties of cereals harvest 2021, obtained from the visible and near infrared (NIR) frequency range	
R.Mihajlov, A. Atanasov, H. Stoyanov and S. Paskaleva.....	74
PS-Dash – Analysis, Monitoring and Visualization of Network Measurements	
P.Vassileva, A. Penev, S. McKee and I. Vukotic	78
Removal of Ocular Artifacts from the Electroencephalogram Signal Flow using Median Filtering	
P.Lyakhov, M. Kiladze, A. Voznesensky and D. Kaplun.....	82

E-LEARNING

Conceptual Model to Evaluate the Learning Process Effectiveness, Extended with Artificial Intelligence Technologies	
M.Hadjiski and R. Kaltenborn	86
Development of a Virtual Conference Online Platform for Adaptive Learning	
V. Jotsov, A. Akramova, G. Tkach, N. Kerimbayev, G. Madyarova, N. Besov and M. Bolyskhanova	91
Selecting a platform for distance learning in an electronic environment	
M.Petrunova, A. Atanassov and D. Pilev.....	96
Secondary effects converted to useful knowledge in e-Learning system	
G.Cholakov	102
The role of information systems in the activities of the State Examination Center	
M.Abbaszade, V. Akbarov and K. Mammadov	106

Comparative Analysis of Li-Fi Simulators for Purposes of the Education	
D.Dinev, V. Alexieva and H. Valchanov	110

E-Learning – the practice in industrial enterprises	
T.Mihova, I. Ivanova and V. Alexieva.....	114

ARTIFICIAL INTELLIGENCE

Hybrid System for Emotion Recognition Based on Facial Expressions and Body Gesture Recognition	
---	--

A.Atanassov, D. Pilev, F. Tomova and V. Kuzmanova.....	120
--	-----

Application of Facial Recognition with PCA and Raspberry Pi for Access Control to Luggage Lockers	
--	--

T.Mladenova, I. Valova and N. Valov	126
---	-----

Vulnerability Type Prediction in Common Vulnerabilities and Exposures Database with Ensemble Machine Learning	
--	--

V.Yosifova	131
------------------	-----

A Novel approach to identify Build Failure Causes involving Machine Learning Techniques	
--	--

S.Shanmugam and S. Sreedhara.....	135
-----------------------------------	-----

Defect inspection for front opening unified pods using a convolutional neural network	
--	--

H.Chang, C. Chang and Y. Chen	140
-------------------------------------	-----

Controlling Adaptation in Affective Serious Games	
--	--

B.Bontchev, I. Naydenov and I. Adamov	144
---	-----

Path Planning and Collision Avoidance with Artificial Intelligence for a Quadrotor UAV	
---	--

M.Karahan and C. Kasnakoglu	148
-----------------------------------	-----

Modeling of a System for Studying of Biological Tissues with the Use of Augmented Reality	
--	--

P.Vasilev, V. Ivanova, R. Andreev and A. Boneva	152
---	-----

COMPUTER TECHNOLOGIES

Design of a Virtual Machine for Training Compilers	
---	--

I.Penev and D. Dimitrov	159
-------------------------------	-----

Exceeding Information Targets in Fixed-Form Test Assembly	
--	--

I.Gospodinov, E. Karaibrahimova and S. Filipov	163
--	-----

A Hot Decomposition Procedure: Operational Monolith System to Microservices	
--	--

N.Ivanov and A. Tasheva	167
-------------------------------	-----

Simple routing algorithm with link discovery between source and destination hosts in SDN networks

D.Todorov, H. Valchanov and V. Aleksieva173

Shortest path routing algorithm with dynamic composite weights in SDN networks

D.Todorov, H. Valchanov and V. Aleksieva177

Android Password Managers and Vault Applications: Comparative Security Analysis

P.Sabev and M. Petrov182

Analysis of 3D technologies for stereo visualization

P.Lebamovski.....190

A New Model of Logo Generator

M.Karova, I. Penev, I. Ivanov and K. Mitev194

SOFTWARE SYSTEMS FOR INDUSTRIAL AUTOMATION

Productivity Improvement in a Class of CNC Machine Tools

M.Zhilevski, M. Mikhov and M. Zhilevska198

IEC/EN 62264 Augmented Reality Manufacturing Operations Research in the scope of Reference Architecture Model for Industry 4.0

P.Vasilev203

Software Systems and Technologies in The Conditions of Industry 4.0

V.Nikolova-Alexieva, K. Valeva and T. Gigova207

Designing 3D-printer Models for Students with Vision Impairment or Low Vision

P.Boychev and S. Boytcheva211

DIGITALIZATION OF SOCIETY

Decision Support in Real Estate Investment by Portfolio Theory

T.Stoilov, K. Stoilova and M. Vladimirov215

First steps towards Open Science in Albania

S.Hasani, E. Stefanova, K. Stefanov and A. Georgiev.....219

Technological space, the concept and capabilities

K.Kirov and K. Proynov223

ANIMAL HUSBANDRY SMART AUTOMATION

Intelligent Solutions for Risk Analysis in Animal Husbandry

S.Dimitrov, T. Stoilov and K. Stoilova 227

Integrated software solutions in animal husbandry

E.Trichkova-Kashamova and E. Paunova-Hubenova 232

Towards CPS/IoT System for Livestock Smart Farm Monitoring

K.Dineva, T. Atanasova, P. Petrov, D. Parvanov, G. Mateeva and G. Kostadinov 236

Cost oriented software system for animal husbandry smart automation

S.Chivarov, N. Chivarov, D. Chikurtev and M. Pleva 240

MODELING AND CONTROL OF DIESEL ENGINES

Advanced mathematical model of slow speed diesel engine

H.Milushev 246

Digital evaluation of the accuracy and sensitivity of a mathematical model of a slow speed marine diesel engine

H.Milushev 250

Analysis of gas exchange of marine diesel engine by equilibration and minimization of deviations in the equilibrium states

G.Enchev 255

Analysis the dynamics of a turbocharger using differential equations

G.Enchev 260

COMPUTER SCIENCE

Blockchains in Enterprise global risk management

I.Popchev, I. Radeva, and V. Velichkova 266

Optimizations in computing the algebraic normal form transform of Boolean functions

M.Pashinska-Gadzheva, V. Bakoev, I. Bouyukliev and D. Bikov 272

Effectiveness of Using Codes With a Sparse Check Matrix for Protection against Algebraic Manipulations

A.Levina, G. Ryaskin, S. Taranov and A. Polubaryeva 276

On the Study of the n-dimensional Boolean Cube in the Undergraduate Programs in Computer Science

V.Bakoev 280

Codes in Star and Bubble-sort graphs	
I.Mogilnykh.....	284
New direction in Cryptography: Homomorphic Encryption	
A.Levina, V. Kadykov and D. Kaplun.....	288
On intersection property of Reed - Muller like codes	
F.Solov'Eva	292
Shader Injection for Instanced 3D Models	
P.Boychev and S. Boytcheva	296

SYSTEM SCIENCE

Expert information, economic rumors, and market self-organization: A lab study	
I.Atanasov, G. Mengov and A. Gerunov.....	300
Algorithmic method to solve three-state systems	
J.Choy, K. Tenekedjiev, B. Mednikarov and N. Nikolova	303
Influence of the Individual Competence of the Experts on the Multicriteria Subjective Assessment	
K.Semova and H. Hristov	307
ZigBee Simulation Framework for Studying the Formation of a Hierarchical Tree Topology	
A.Haka, V. Aleksieva and H. Valchanov.....	311
Maximal covering of a point set by a system of circles via simulated annealing	
S.Filipov, S. Panov, F. Tomova and V. Kuzmanova	315
Complex multivalued hierarchical logic with one real and two imaginary logical structures	
V.Sgurev.....	324

COMPUTER NETWORKS SIMULATION

A Client Tier for the EMULSION IoT Platform	
I.Ganchev, Z. Ji and M. O'droma	329
A Modelling & Simulation Tier for the EMULSION IoT Platform	
I.Ganchev, Z. Ji and M. O'droma	333
A Sensor Tier Design for the EMULSION IoT Platform	
I.Ganchev, Z. Ji and M. O'droma	337
Simulation Environment for Bluetooth Low Energy Network	
A.Haka, Y. Yordanov, V. Aleksieva and H. Valchanov.....	341

Simulation Software For Finding Best Route in LoRaWan Network	
D.Dinev, V. Aleksieva, H. Valchanov and K. Genov.....	345

Model and prototype of interactive assistant for compliant interface development – MayUI tool	
M.Stoeva	349

APPLICATIONS I

Application of Method for Constructing a Complex Hierarchical Logic in Intelligent Agriculture Context	
T.Glushkova, S. Stoyanov, V. Sgurev, L. Doukovska and A. Dukovski.....	355

Architecture of a Knowledge Base in Smart Crop Production	
A. Stoyanova-Doycheva, V. Ivanova, L. Doukovska, V. Tabakova, I. Radeva and S. Danailova.....	359

Ambient-oriented CCA Modeling in Agriculture-151	
T.Glushkova, S. Stoyanov, K. Rusev, I. Krasteva and N. Moraliyska	364

An Event Model for Smart Agriculture	
S. Stoyanov, A. Stoyanova-Doycheva, V. Ivanova, V. Tabakova-Komsalova, V. Monov and Z. Radeva.....	368

Infrastructure Model of Intelligent Pasture	
E.Valchev, J. Todorov, I. Stoyanov , V. Monov, B. Dimitrov and L. Doukovska	372

ROBOTICS

Kinematic model and analysis of an anthropomorphic robotic finger	
G.Mihalev and S. Yordanov.....	376

Evaluation of Search Strategy for Autonomous Rescue Mobile Robot	
A.Güllü and H. Kuşçu	382

Modelling and Control of 2-DOF Underwater Manipulator in Presence of Disturbances	
Z.Zhekov and N. Atanasov	387

Extended Research of Neural Control System for 2-DOF Underwater Manipulator	
Z.Zhekov	391

Review and Analysis of Robotized Feeding Systems	
E.Blagoeva, B. Karkov and N. Stoimenov.....	395

Automatic Beacon Selection for Indoor Localization	
R.Ivanov	399

COMMUNICATION

Analysis of swarm application layer protocols (SALP) used in event-driven communication A.Anguelov, R. Trifonov and O. Nakov	404
Intelligent Management of IoT Devices with Limited Connectivity B.Toskov, A. Toskova, S. Bogdanov and N. Spasova	408
Efficiency of data exchange of IoT communication protocols N.Kaskatiiski and L. Boyanov	412
Characterization of the communication traffic generated by power electronic devices I.Nedyalkov	416

COMPUTER NETWORKS

Analysis of Threats to a University Network Using Open Source Technologies G.Tsochev, R. Trifonov, S. Manolov, O. Nakov and S. Spasov	420
Architectural Approach to Design of a Corporative Computer Network K.Kolev, and M. Popnikolaev	424
Intelligent IoT Gateway B.Toskov, A. Toskova, S. Bogdanov and N. Spasova	428
Input Arbiter for Router Allocator in MPP Computers with Double-loop Hypercube Network Topology M.Angelov	432

APPLICATIONS II

Road traffic modelling and development of a specific traffic light control system D.Dzhibarov and I. Grigorov	436
Cloud based architecture for Intelligent Transportation System T.Mecheva and N. Kakanakov	439
Entropy and hierarchy of competition in the world semiconductor market I.Petrov	443
Computing the Processing Medium Temperature and Heat Fluxes in the Beginning of Regimes for Autoclave Steaming of Frozen Wood Materials M.Hadjiski, N. Deliiski and D. Angelski	447
Investigation of the Magnetic Forces in Drum Separator with Permanent Magnets T.Dimova, B. Aprahamian, M. Streblau and M. Marinov	452

Determining the Magnetic Forces in a Suspension Type Separator with Permanent Magnets T.Dimova, B. Aprahamian, M. Streblau and M. Marinov	456
Analysis of The Transient Process in a Direct Start-up of an Induction Motor, by Use of COMSOL Multiphysics M.Todorov, M. Streblau, M. Marinov and T. Dimova	460
Achieving Energy Efficient Household Equipment Through Application of Induction Hobs Y.Slavova, M. Streblau, M. Marinova and B. Danov	464

SECURITY

"Cyber-Security of Industrial Computer Systems" - Differentiation as a Separate Discipline R.Trifonov, O. Nakov, S. Manolov, G. Tsochev and G. Pavlova	468
Analysis of practical cyberattack scenarios for wind farm SCADA systems E.Sabev, R. Trifonov, G. Tsochev, G. Pavlova and K. Raynova.....	474
Using Machine Learning Reacted with Honeypot Systems for Securing Network G.Tsochev, M. Sharabov and A. Georgiev.....	479
Machine Secret Key Recognition in a Homogeneous Environment D.Todorov and M. Karova.....	483
Vulnerabilities Space and the Superiority of Hackers W.Dimitrov, G. Dimitrov, K. Spassov and L. Petkova	487
COVID-19 detection with X-Ray input data M.Nikolov, G. Tsenov and V. Mladenov	491