

# **2024 IEEE Ural-Siberian Conference on Biomedical Engineering, Radioelectronics and Information Technology (USBEREIT 2024)**

**Yekaterinburg, Russia  
13-15 May 2024**



**IEEE Catalog Number: CFP24P00-POD  
ISBN: 979-8-3503-6290-9**

**Copyright © 2024 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:	CFP24P00-POD
ISBN (Print-On-Demand):	979-8-3503-6290-9
ISBN (Online):	979-8-3503-6289-3
ISSN:	2769-3627

**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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

A Hook-Shaped MIMO Antenna Array for Various Applications in Millimeter-Wave Frequency Band .....	1
<i>Iftikhar U. Din, Sadiq Ullah, Nisar A. Abbasi</i>	
Interaction of a Transverse Electric Signal Wave with a Spatially Periodically Modulated Magnetodielectric Plate in a Waveguide.....	5
<i>Eduard Gevorkyan</i>	
Elastic Water Hammer Effect in Arterial Network: Origin of the Tidal and the Dicrotic Wave in Blood Pressure Waveforms.....	8
<i>Lucian Evdochim, Aleksei E. Zhdanov, Anton Y. Dolganov, Lidia Dobrescu, Dragos Dobrescu</i>	
Deep Learning Based Speech Recognition for Hyperkinetic Dysarthria Disorder.....	12
<i>Antor M. Hashan, Chaganov R. Dmitrievich, Melnikov A. Valerievich, Dorokh D. Vasilyevich, Khlebnikov N. Alexandrovich, Bredikhin B. Andreevich</i>	
Development of a Hardware-Software Complex for the Implementation of a Hypoxic Model of Pulmonary Heart Failure in Laboratory Animals .....	16
<i>Daniil Kuznetsov, Aleksandr Balakin, Yuri Protsenko</i>	
Linguistic Nuances in Text Analysis: TF-IDF Metric's Algorithm Implementation for the Karakalpak Language Recognition .....	19
<i>Davlatiyor Mengliev, Mukhriddin Eshkulov, Vladimir Barakhnin, Ruslan Abdullayev, Nodirbek Boltayev, Bahodir Ibragimov</i>	
X-Band Holographic Antennas Back Radiation Comparison.....	23
<i>Liubov M. Liubina, Svyatoslav V. Ballandovich, Grigory A. Kostikov, Yuriy G. Antonov, Mikhail I. Sugak</i>	
Visual Designing Knowledge Bases for Aircraft Diagnostics using State Transition Diagrams .....	27
<i>Aleksandr Y. Yurin, Nikita O. Dorodnykh, Yuri V. Kotlov, Aleksandr L. Kivokurtsev</i>	
A Unified Algorithm for Robotic-Assisted Cardiac Endovascular Surgery .....	31
<i>Natalia M. Alekseeva, Alexander G. Viller, Alexey M. Romanov</i>	
Long Text Classification with Segmentation.....	36
<i>Ekaterina Mayatskaya</i>	
High-Speed Operational Amplifier Based on a Modified “Folded” Cascode.....	39
<i>Dmitry Kuznetsov, Alexey Titov, Nikolay Prokopenko, Nikolay Butyrlagin</i>	
Software Development and Testing of an Operating Point Controller for Mach-Zehnder Modulators Based on Lithium Niobate Crystal .....	43
<i>Dmitriy Masalkin, Aleksei Sosunov, Roman Ponomarev, Anton Zhuravlev, Kirill Ivanov</i>	
SUID Binaries in GNU/Linux: The Feature or the Bug?.....	46
<i>Andrey M. Kanner, Tatiana M. Kanner</i>	
Comparison of Evolutionary Optimization Methods on the Example of Rastrigin Function.....	49
<i>Andrey S. Korobko, Timur T. Gazizov, Mikhail Moskalev</i>	
Streaming Bayesian Models with Hamiltonian Monte Carlo .....	54
<i>Alexey V. Calabourdin, Konstantin A. Aksenov</i>	

Alternative Estimates of Heart Rate Based on Remote Photoplethysmography Signals Intellectual Analysis.....	59
<i>Leonid V. Labunets, Mariya Y. Ryakhina</i>	
Computer Vision in Assessment of Complexity of Exercises of Figure Skating.....	63
<i>Irina Novikova, Sergey Romanenko, Oxana Kulikova, Vladislav Sezganov, Natalia Veremchuk, Vladislav Sarychev</i>	
Assessing the Impact of External Influences During Packet Transmission Between Two Endpoints .....	67
<i>Danil I. Burumbaev, Valery T. Kuanishev, Nikolai M. Barbin</i>	
New Load Forecasting Ensemble Model Based on LightGBM for Gas Industry Enterprises.....	71
<i>Alina I. Stepanova, Pavel V. Matrenin</i>	
An Approach to Counteracting Adversarial Attacks on Image Recognition Based on JPEG-Compression and Neural-Cleanse .....	76
<i>Igor Kotenko, Igor Saenko, Oleg Lauta, Nikita Vasiliev, Vladimir Sadovnikov</i>	
Using a Hybrid Automaton to Model the Protected System and Detect Anomalies in Network Traffic .....	80
<i>Alexey Sinadskiy</i>	
Sequential Analysis of Cryptojacker Sings Based on the Wald Criterion.....	84
<i>Nikolay Gaidamakin</i>	
Adaptive Sequential Threshold Analysis of Cryptojacker Sings Based on the Criterion of Maximizing Statistical Distinguishability by Bhattacharyya Distance.....	88
<i>Nikolay Gaidamakin</i>	
Detecting DNS Tunnels using Machine Learning .....	92
<i>Nikita Bykov, Yuri Chernyshov</i>	
Algorithm for Finding the Optimal Optical Power in a Fiber Optic Power Transmission System.....	95
<i>Aleksey Garkushin, Egor Urbanovich, Elizaveta Nifontova, Sergey Storozhev, Igor Volkhin, Viktor Krishtop, Vitaly Maksimenko</i>	
Hardware and Software Model of an Artificial Lung Ventilator .....	98
<i>Kirill Stafeev, Andrey Gusev, Oleg Plokhikh, Danil Nasibullin, Oleg Kuvшинов, Kirill Ignatkov</i>	
Second-Order Discrete-Analog Filters on Switched Capacitors with Two Electronic Keys .....	102
<i>Darya Denisenko, Nikolay Prokopenko, Nikolay Butyrlagin, Yuri Ivanov</i>	
Discrete-Analog Filters on Switchable Capacitors with a Summator of Input and Output Signals on a Differential Difference Operational Amplifier.....	106
<i>Darya Denisenko, Alexey Titov, Nikolay Prokopenko, Nikolay Butyrlagin</i>	
Segmentation of Retinal Layers in OCT Images using Deep Learning Algorithms for Medical Diagnostics .....	110
<i>Andrey Pershin, Vasili Borisov</i>	
AI Hallucinations: Is “Artificial Evil” Possible?.....	114
<i>Vadim Perov, Nina Perova</i>	
Radio-Wave Motion Transducer for Measuring the Parameters of Torsional Vibrations of a Turbine Unit Shaft .....	118
<i>Andrey Gretskov, Ulyana Boyarkina, Dmitriy Vorokh</i>	

Development of an Algorithm for Audiovisual Sensory Substitution with YOLO Network Preprocessing to Reduce the User's Sensory Overload.....	122
<i>Egor A. Koryukin, Anastasia S. Butorova, Veniamin S. Bobakov, Aleksandr P. Sergeev</i>	
Comparative Analysis of Image Sonification Algorithms for Assistive Technology of Sensory Substitution.....	126
<i>Anastasia S. Butorova, Egor A. Koryukin, Alina A. Kostromina, Elizaveta N. Shikhova, Nadiya M. Khomenko, Aleksandr P. Sergeev</i>	
Multi-Channel Control System using Force Myography.....	130
<i>Pavel Chibizov, Maksim Petrov, Vladislava Kapravchuk, Veronika Mazeina, Andrey Briko</i>	
Text Tonality Analysis using Deep Neural Network .....	135
<i>Evgeny Zimin, Nikolay Arkhipov, Evgenii Saichik</i>	
Labeling Data and Neural Network Training for Drone Detection Task .....	139
<i>Andrey Sheka</i>	
Theoretical Substantiations of Registration and Analysis of EEG to Increase the Reliability of Neurofeedback Training (NFT) .....	143
<i>Olga Bazanova, Ekaterina Nikolenko, Alexander Zakharov, Tatyana Maryanovsaya</i>	
Quantization and Phase Noise Impact on Retransmission Simulator Radar Jamming .....	147
<i>Andrey A. Durnakov, Alexander S. Bokov</i>	
Kitsune Dataset Analysis via BigData and Deep Learning Techniques.....	152
<i>Igor Zelichenok, Igor Kotenko</i>	
C-Band Waveguide T-Junction Design with Adjustable Impedance Matching .....	156
<i>Konstantin Burlakov, Kirill Ignatkov, Sergey Shabunin</i>	
A System for Risk Equalities for $n$ Binary Factors.....	159
<i>Julia Nagrebetskaya, Vladimir Panov</i>	
Application of an Analog-to-Information Converter Algorithm in FMCW MIMO Radar .....	163
<i>Yury M. Meleshin, Vadim N. Karpov, Marat S. Khasanov, Ekaterina V. Ushakova, Ilya A. Kuzmin</i>	
Reducing the Orbital Angular Momentum Waves Divergence with a Lens to the Utilized Antenna Array.....	166
<i>Artem A. Airapetian, Maxim V. Azarov, Yury M. Meleshin, Konstantin S. Lyalin</i>	
Peculiarities of Intraoperative Measurements of Hearing Cochlear Implants CI 512 and CI 612 Installed in Russia .....	170
<i>Nikita S. Melnikov, Alexander G. Kozlov</i>	
Deep-Learning Based Localization of Myocardial Fibrosis in CMR Images.....	174
<i>Walid Al-Haidri, Anatoliy Levchuk, Nikita Zotov, Anton Ryzhkov, Vladimir Fokin, David Bendahan, Ekaterina Brui</i>	
ISFET with CMOS IC Combined with DNA Aptamer to Detect NT-proBNP .....	178
<i>Andrey Sheshil, Alexey Titov, Vitaliy Grudtsov, Amir Gabdrakhmanov, Dmitriy Ryazantsev, Natalia Komarova</i>	
Ethical AI: Conceivable Versions and Projected Issues.....	182
<i>Vadim Perov, Nina Perova</i>	

AI Systems and the Possibility of Moral Decision-Making in Smart Cities.....	185
<i>Anna Kartasheva, Daria Tomiltseva</i>	
Design of the Glucose Metabolism Simulator for Personalized Automated Insulin Therapy Systems Development .....	188
<i>Elina I. Strukova, Dmitry A. Chuprakov, Kirill V. Pozhar, Evgeniia L. Litinskaia</i>	
Verification and Correction of the Actual Response Content of a Large Language Model by Publicly Available Software Tools.....	192
<i>Makar Shatiov, Evgeny Danilov, Ilya Kashin</i>	
Ethics Documents in the Field of AI. Concepts, Achievements and Problems.....	196
<i>Vadim Perov, Vladislav Golovkov</i>	
Dorsal Hand Vascular Imaging System .....	200
<i>Pavel V. Mizinov, Natalia S. Konnova, Oleg V. Kravchenko, Dobroslav P. Egorov, Gavriil V. Osipenko</i>	
Classification with PPMd Compression in Few-Shot Learning: The Case of Eye-Tracking Dyslexia Detection .....	204
<i>Marina Abrosimova, Anna Rebak, Roman Novikov, Nikita Markov</i>	
Smart Contract Vulnerability Classification and Severity Approaches .....	208
<i>Iskander Zulkarneev, Alexey Alexeev, Leonid Chernyatin</i>	
Usage of Noise-Resistant Coding for Stable Data Transmission Over Household Electrical Networks .....	212
<i>Alexander N. Shmatok, Maria K. Zolotenkova, Vasily V. Egorov</i>	
The Dilemma of Sufficient Prediction Accuracy in Educational Recommendation Services .....	217
<i>Tatyana A. Oreshkina, Anna A. Kartasheva, Lyubov D. Zabokritskaya</i>	
Intracranial Recordings During Down-Regulation of Positive Emotions .....	220
<i>Nikita Ostavnov, Tommaso Fedele, Nikita Utyashev, Andrey Zuev, Vladimir Kosonogov</i>	
Strong AI and the Biotechnological Moral Enhancement .....	224
<i>Igor Larionov, Nina Perova</i>	
Security Problems of using the Microsoft Office Package .....	228
<i>Dmitry Kuts, Sergey Porshnev, Maria Kuts, Dmitry Terekhin, Sergey Dolbikov, Sokolov Ilya</i>	
Development of a Bench for Testing Ultrasonic Surgical Systems .....	233
<i>Ivan D. Kashkarov, Aleksandra M. Tarasovskaya, Nikita V. Belikov, Anna S. Borda, Irina V. Khaydukova</i>	
Implementing Machine Learning in the Context of Web Application Firewalls .....	237
<i>Alexandr Kozhevnikov, Yuri Chernyshov</i>	
Application of Radio-Wave Motion Transducers to Measure the Parameters of Bending Vibrations of a Turbine Unit Shaft .....	241
<i>Andrey Gretskov, Ulyana Boyarkina, Dmitriy Vorokh</i>	
Radiation from an Aperture Antenna in the Near-Field of a Reflecting Surface .....	245
<i>Adnan M. Taha, Sergey Shabunin</i>	
Cardiac-Related Signal Extraction in Thoracic Impedance Measurement .....	249
<i>Yaroslav Zakharchenko</i>	

An Experimental Repeatability Evaluation of Running Laboratory Equipment for Heating Donor Blood Plasma Prior to Transfusion .....	253
<i>Vakhtang Lemondzhava, Andrey Kasyanov</i>	
Features of Creating Accounts in Linux OS .....	257
<i>Ilia Sokolov, Sergey Porshnev, Valentin Baklanov, Ksenia Sherbakova, Dmitry Kuts</i>	
Noise Effects in a Current Driver for a Neurostimulator .....	261
<i>Kirill A. Mironov, Denis B. Akhmetov, Ivan A. Rumyancev</i>	
Analysis of the Design of Broadband Horn Antennas Based on the Vivaldi Antenna.....	264
<i>Alexey N. Korotkov, Andrey N. Lozhkin</i>	
Enhancing Intrusion Detection Through Data Perturbation Augmentation Strategy .....	269
<i>Uneneibotejit J. Otokwala, Andrey V. Petrovskiy, Igor V. Kotenko</i>	
Multi-Walled Carbon Nanotubes-Based Glucose Biofuel Cell Operating in Rats' Brains .....	273
<i>Ekaterina Vakhnitskaya, Yulia Parunova, Anna Rybakova, Pavel Gotovtsev</i>	
Fine-Tuning Large Language Models to Provide Accurate Recognition of User Intent for Aviation Q&A Systems .....	277
<i>Sun Lina, Konstantin A. Aksyonov</i>	
Efficient Rock Fragmentation Estimation on Conveyor Belts using YOLOv8-Based Oriented Bounding Box Method .....	280
<i>Kirill Reshetnikov, Mikhail Ronkin</i>	
Optimization of Phase Synchronization of Radio Pulses of a Transistor Microwave Self-Excited Oscillator .....	284
<i>Sergey Kudinov, Viacheslav Ivanov</i>	
Full-Wave Analysis of Microstrip and Slotlines .....	288
<i>Ekaterina Anashkina, Konstantin Burlakov, Fousseny M. Sidibe, Sergey Knyazev, Lubov Lesnaya, Sergey Shabunin</i>	
The Specificity of the Lengthened Objects Detection Algorithm to the Variable Parameters .....	292
<i>A. K. Sorokin</i>	
Deformation Velocity in the Porcine Ventricular Epicardium During Acute Ischemia in in Situ Experiments.....	296
<i>Daria Mangileva, Maria Grubbe, Alexander Kursanov, Olesya G. Bernikova, Alena S. Tsvetkova, Alexey O. Ovechkin, Jan Azarov, Leonid Katsnelson, Olga Solovyova</i>	
Application of Liquid Rank Reputation System for Twitter Trend Analysis on Bitcoin .....	300
<i>Abhishek Saxena, Anton Kolonin</i>	
Explaining of Transformer-Based Models for Vulnerable Function Detection .....	304
<i>Zalina Rusinova, Yury Chernyshov, Anton Dolganov</i>	
Numerical Optimization of Multichannel Rx-Only RF Coil for Parallel Imaging at 0.07T .....	308
<i>Aleksi Nasonov, Georgiy Solomakha, Anna Hurshkainen</i>	
Statistical Analysis of Electroretinogram Signals.....	311
<i>Nikita S. Denisov, Leonid G. Dorosinskiy, Aleksey E. Zhdanov, Iakov A. Golentsev</i>	
Microstrip High-Pass Filter Based on Multimode Resonator.....	315
<i>Boris Belyaev, Sergey Khodenkov, Alexey Popov, Natalya Shepetka</i>	

ERG Classification by using ML Methods Based on Short-Time Fourier Transform.....	318
<i>Faisal B. Albasu, Mikhail Kulyabin, Aleksei Zhdanov, Anton Dolganov, Vasilii Borisov,     Mikhail Ronkin</i>	
U-NET with Extreme Learner Approach in Retinal Vessel Image Segmentation .....	322
<i>Igor Chekhomov, Abbas F. Al Mashhadani</i>	
Intrusion Detection and Prevention System AI Based Features with Random Forest .....	326
<i>Mohammed B. Al-Door, Evgeny I. Komotskiy</i>	
Information Security Models and Algorithms using Generative-Adversarial Neural Networks and User Data.....	330
<i>Nikita S. Udilov</i>	
Optoelectronic Microwave Oscillator. Advantages and Disadvantages. Noise Sources in an OEO.....	333
<i>Alexander Luchinin, Ivan Malygin</i>	
GreenTensor Electromagnetic Library for Calculating Scattering Patterns on a Human Head Model.....	338
<i>Dmitriy V. Denisov, Ilia O. Skumatenko, Mikhail A. Shesterov</i>	
Directional Antenna with Circular Polarization in the UHF Range.....	341
<i>Alexey N. Korotkov, Elena S. Malenkikh</i>	
Development of an Enlarged Lange Coupler .....	344
<i>Alexey N. Korotkov, Elena S. Malenkikh, Matvey I. Sadovnikov, Maxim O. Kultyshev, Pavel V.     Kuznetsov</i>	

#### **Author Index**