

2020 21st International Conference of Young Specialists on Micro/Nanotechnologies and Electron Devices (EDM 2020)

**Chemal, Russia
29 June – 3 July 2020**



IEEE Catalog Number: CFP20500-POD
ISBN: 978-1-7281-6847-0

**Copyright © 2020 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:	CFP20500-POD
ISBN (Print-On-Demand):	978-1-7281-6847-0
ISBN (Online):	978-1-7281-6846-3
ISSN:	2325-4173

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

Table of Contents

Section I. Semiconductor Physics and Technology

Section Chair: Nataliya L. Shwartz

1. Microcrystallites and Granularity of Detonation Nanodiamonds Anastasia A. Kolesova, Evgenii A. Petrov	1
2. Removal of Oxides from the Surface (001)InP in Ultra-High Vacuum in an Arsenic Flux Dmitriy V. Dmitriev, Ivan A. Mitrofanov, Danil A. Kolosovsky, Alexander I. Toropov, Konstantin S. Zhuravlev	5
3. Monte Carlo Simulation of GaSb Cluster Formation on Si(111) substrate Pavel V. Zhikharev, Nataliya L. Shwartz	9
4. Optimal Stage Determination of Sapphire Nitridation Process Completion under High-Energy Electron Beam Influence Denis S. Milakhin, Timur V. Malin, Vladimir G. Mansurov, Yury G. Galitsyn, Konstantin S. Zhuravlev	14
5. Annealing Kinetics of GaAs under Incongruent Evaporation Conditions Anna A. Spirina, Nataliya L. Shwartz	19
6. The Development of Deep Diffusion Modes Involved in Production of Semiconductor Structures for the TVS with a Breakdown Voltage of 800 V Ivan Krasniy, Sergei Akimov, Aleksandr Berkin	23
7. Effect of Post Growth Annealing on Phase Transition Parameters in LP CVD Grown Vanadium Dioxide Thin Films Kirill E. Kapoguzov, Sergey V. Mutilin, Victor Ya. Prinz, Lyubov V. Yakovkina	28
8. Self-catalyzed GaAs Nanowire Growth at Alternate Arsenic Flux Pavel V. Shipulin, Alla G. Nastovjak, Nataliya L. Shwartz	32
9. Influence of the Preliminary Annealing Conditions on Step Motion at the Homoepitaxy on the Si(100) Surface Michael Yu. Yesin, Alexander I. Nikiforov, Alexander S. Deryabin, Vyacheslav A. Timofeev	36
10. A Novel Structure of the Silicon Transient Voltage Suppressor with Negative Differential Resistance Sergey D. Akimov, Ivan B. Krasniy, Dmitriy I. Ostertak, Anatoliy E. Glushkov	42
11. Fabrication of 2D Crystals by Intercalation of a Bulk ZnWO ₄ Single Crystals Aleksandr I. Komonov, Regina A. Soots, Vladimir N. Shlegel, V. Ya. Prinz	48
12. Electromagnetic Response of 3D-printing Carbon-containing Matrix Structure at Sub-THz Frequency Range Alexander V. Badin, Grigorii E. Kuleshov, Kirill V. Bilinsky, Kseniya V. Simonova	53
13. Electrophysical Characteristics of Sub-THz Diode with Schottky Barrier Victoriya D. Moskalenko, Alexander V. Badin, Diana A. Pidotova	59
14. Tunable Chiral Metamaterial for Polarization Control in Microwave Region Valentin A. Seyfi, Alexey E. Gayduk, Victor Ya. Prinz	64
15. Microwave Induced Damping of the Shubnikov-de Haas Oscillations in Rolled Nanomembrane in Ballistic Transport Mode Denis B. Sultanov, Alexander B. Vorob'ev, Anatoly F. Buldygin, Alexander I. Toropov	68
16. Simulation of Plasmon Enhanced Radiation from SiGe Quantum Dots Combined with Silver Nanoparticles Nikita A. Polovnikov, Vladimir A. Zinovyev, Anatoly V. Dvurechenskii	72
17. Interaction of Laser Radiation with Transparent Material Porous Targets Vladimir V. Osipov, Vasily V. Lisenkov, Vyacheslav V. Platonov, Egor V. Tikhonov	76

**Section II. Radio and Microwave Technology.
Information Technology and Telecommunications**
Section Chairs: Svetlana V. Vorobiova, Maksim A. Stepanov

1. Theoretical Limits of PHY and MAC for 5G Machine Type Communications Alexander Loshkarev, Vera Drozdova	83
2. Towards the Study of High-Frequency Phased Antenna Array Components Sergey A. Alekseytsev, Alina V. Bondareva, Anatoly P. Gorbachev, Yuriy N. Parshin	87
3. Sub-Nyquist Sampling of Single Tone Signal Sergei F. Atkishkin	94
4. Performance Analysis of UWB Communication Receiver in Multipath Environment Based on RAKE Receiver Vitaly A. Karbolin, Vladimir I. Nosov, Vyacheslav O. Kalinin	98
5. Integrated Cartesian Feedback with Automatic Phase Adjustment and Power Amplifier Rodion R. Fakhrutdinov, Sergey A. Zavyalov, Konstantin V. Murasov, Alexey N. Liashuk	104
6. Approach to Implementation Full-duplex Communication Technology in Power Line Communication Systems Andrey K. Movchan, Eugeniy V. Rogozhnikov, Edgar M. Dmitriev, Dmitriy A. Pokamestov, Kirill V. Petrovskiy	112
7. Multicriteria Optimization of a Three-Conductor Modal Filter Using Mass-Dimensional Criterion Anton O. Belousov	118
8. Electrophysical Properties of Carbon Filaments for 3D Printing Grigoriy E. Kuleshov, Tatyana N. Shemaitlo, Maxim O. Gering	123
9. Additive Technologies in the Protection of Electronic Equipment from Electromagnetic Radiation Daria D. Teterina, Igor O. Dorofeev, Alexander V. Badin	128
10. An Approach for Increasing the Discretization Interval along Radial Coordinate in Terrain Reflections Model Margarita V. Oreshkina	134
11. Features of Modeling Ultra-Wideband Pulse-Based Radio Systems for Communication Networks of Autonomous Unmanned Aerial Vehicles Groups Vyacheslav O. Kalinin, Vladimir I. Nosov, Vitaliy A. Karbolin	138
12. Performance Analysis of Dynamic Bandwidth Allocation Algorithms in GPON Victor S. Simonov, Alexander A. Malyavko	144
13. Revealing New Possibilities of Ultrashort Pulse Decomposition in a Turn of Asymmetrical Meander Delay Line Alexander V. Nosov, Roman S. Surovtsev	149
14. TEM cell for Testing Low-profile Integrated Circuits for EMC Alexander V. Demakov, Maxim E. Komnatnov	154
15. Additional Pulses in the Time Response of a Modal Filter with a Passive Conductor in the Reference Plane Cutout Maria A. Samoylichenko	159
16. Reflection Symmetric Meander Line Protecting against Ultrashort Pulses Evgeniya B. Chernikova, Anton O. Belousov	165
17. Approach to Estimation of Radiated Emission from Circuits with Modal Reservation Adnan Alhaj Hasan, Alexey A. Kvasnikov, Talgat R. Gazizov	169
18. The Detection of Voltage Extreme Points of the Shielded Power Supply Bus under the Ultrashort Pulse Excitation Rustam R. Gazizov, Ruslan R. Gazizov, Timur T. Gazizov	174
19. A Device for an Ultrashort Pulse Attenuation in Common and Differential Modes in the High Voltage Power Supply Circuits of the Spacecraft Roman R. Khazhibekov, Yevgeniy S. Zhechev, Valerii P. Kosteletskii, Alexander M. Zabolotsky	179
20. Modal Analysis of a Microstrip Line with Polygons in the Air Indira Y. Sagiyeva, Talgat R. Gazizov	183

21. Using Composite Insulating Materials to Improve Modal Filter Performance	187
Evgeniya B. Chernikova, Anton A. Ivanov	
22. The Influence of Temperature on Microstrip Transmission Line Characteristics	191
Indira Y. Sagiyeva, Alexander V. Nosov, Roman S. Surovtsev	
23. Spectral Characteristics of Spatiotemporal Signals and Interference on a Linear Antenna Array	195
Daria N. Zima, Alexandr A. Spector, Darya O. Sokolova	
24. Experimental Study of the Buried Vias Effect on Reflection Symmetric Modal Filter Performance	200
Yevgeniy S. Zhechev	
25. Cryogenic Low Noise Amplifiers and Filters for Superconducting Qubit Readout	205
Boris I. Ivanov, Dmitriy I. Volkhin, Ilya L. Novikov, Alexey G. Vostretsov	
26. Verifying Reflex-software with SPIN: Hand Dryer Case Study	210
Tatiana V. Liakh, Natalia O. Garanina, Igor S. Anureev, Vladimir E. Zyubin	

Section III. Sonic and Ultrasonic Devices: Physics, Electronics, Application Section Chair: **Alexsey I. Soldatov**

1. Change in Size of Nanodiamond Agglomerates during Ultrasonic Treatment of Suspensions	215
Khristina N. Solovyeva, Olga B. Kudryashova, Alexander L. Vereschagin, Eugeny A. Petrov	

Section IV. Optical-electronic Devices and Systems: Physics, Electronics, Application Section Chair: **Eugene V. Sypin**

1. A New Approach to Physical Encoding in VLC Data Transmission Technology	221
Egor A. Grigoryev, Alexander E. Baklanov, Svetlana V. Grigoryeva, Aslima Zh. Alimkhanova, Vladimir M. Sayun	
2. The Main Principles of Development of an Intelligent Multi-Channel Radiation Thermometer	226
Nadezhda S. Chernysheva, Anton B. Ionov, Boris P. Ionov	
3. Operation of a Capacitive Pumped CuBr Laser in a Reduced Energy Deposition Mode	234
Ilya S. Musorov, Dmitriy N. Ogorodnikov, Dmitriy V. Shiyanov, Victor B. Sukhanov, Stanislav N. Torgaev, Gennadii S. Evtushenko	
4. Simulation of Electro-optical Device for Fire Detection on Basis of Spectral Pyrometry Method	238
Aleksey Yu. Sidorenko, Sergey A. Lisakov, Andrey I. Kin, Eugene V. Sypin	
5. Simulation of Gas Contamination by Methane in Blind Drift of Coal Mine	244
Sergey A. Lisakov, Anton I. Sidorenko, Eugene V. Sypin	
6. Simulation of Dustiness in the Blind Drift of Coal Mine	253
Sergey A. Lisakov, Anton I. Sidorenko, Eugene V. Sypin	
7. Development of Comprehensive Method for Enhance of Decision-Making Reliability at Fire Detection against Background of Dynamic Optical Interference by Electro-Optical Device of Two Spectral Ratios	263
Alexey Yu. Sidorenko, Nadezhda Y. Tupikina, Andrey I. Kin	
8. Laboratory Model for Low Current Excitation of Metal Vapor Active Media Lasers	272
Pavel I. Gembukh, Valeriy F. Fedorov, Dmitriy V. Shiyanov, Maxim V. Trigub	
9. Simulation of the Fire in the Working of Coal Mine Using the Fire Dynamics Simulator Software	276
Andrey I. Kin, Anton I. Sidorenko	
10. Metal Vapor Active Element with Inductive Dispenser	285
Konstantin Yu. Semenov, Valeriy F. Fedorov, Dmitriy V. Shiyanov, Maxim V. Trigub	
11. Digital Range-Gated Surveillance Device without an Image Intensifier	289
Alexandr A. Golitsyn, Natalia A. Seyfi	

12. Multi-Area Range Measurement Method Using Active-Pulse Television Measuring Systems	293
Elizaveta S. Chaldina, Andrey K. Movchan, Vyacheslav V. Kapustin, Mikhail I. Kuryachiy	
13. Modeling the Electromechanical Properties of the MEMS Element of a Thermoelectric Infrared Sensor Based on the Dynamic Seebeck Effect	298
Gleb D. Demin, Renat Z. Khafizov, Evgeny A. Fetisov, Nikolay A. Djuzhev	

Section V. Power Electronics and Power Engineering

Section Chair: Gennady S. Zinoviev

1. Multifunction AC Voltage Regulator for Connecting an Induction Motor to Alternating Power Supply	304
Dmitry I. Panfilov, Ivan I. Zhuravlev, Michail I. Petrov, Ahmed E. ELGebaly	
2. Control Algorithms of Discrete Reactive Power Compensators with PI and Fuzzy Logic Controllers	311
Ahmed E. ELGebaly, Dmitry I. Panfilov, Roman N. Krasnoperov	
3. Possibility of Aircraft Electrical Equipment Diagnostics by the Local Load Control Units	318
Nikolay A. Simankov, Alexandr A. Savelov, Sergey P. Khalyutin, Albert O. Davidov	
4. Research of the Laboratory Prototype for the Battery Charging System Based on Wireless Power Transfer	324
Irina Yu. Semykina, Valery M. Zavyalov, Victor N. Krylov	
5. Designing DC/DC Converters with Impulse Loads for Secondary Supply Systems of Transmit/Receive Modules for Active Phased Array Antennas of Radars	331
Vladimir F. Dmitrikov, Dmitry V. Shushpanov, Alexander Y. Petrochenko, Zinaida V. Zaytseva	
6. Simulation Model of Spacecraft Power System for Power Balance Calculation	340
Roman V. Kozlov, Victor G. Bukreev, Mikhail V. Nesterishin, Alexander T. Lelekov	
7. Multi-level Voltage Inverter with Structure Invariant to the Number of Levels of the Output Curve	346
Ekaterina E. Mirgorodskaya, Nikita P. Mityashin, Yuri B. Tomashevskiy, Yuri M. Golembiovsky, Alexey Yu. Miroshnichenko, Dmitry Yu. Lukov	
8. Balancing of the Magnetization Reversal Mode of the Bidirectional Three-port DC Converter	352
Dmitry Yu. Lukov, Ekaterina E. Mirgorodskaya, Yuri M. Golembiovsky, Yuri B. Tomashevskiy, Nikita P. Mityashin	
9. Research of a Soft Starter of an Induction Motor Based on Multi-Zone Transistor AC Voltage Regulator	358
Evgeniy A. Kosykh, Aleksey V. Udovichenko	
10. Analysis of Small-Switches AC Voltage Regulator with Switching Capacitors	363
Aleksey V. Udovichenko, Gennady S. Zinoviev	
11. Microgrid Voltage and Frequency Control Using Droop Control Based on Master/Slave Method	367
Mojtaba Abbasi, Mehdi Hedayatpour, Alexander G. Garganeev	
12. Multiport DC-DC Converter with Additional Inductance for Spacecraft Power Systems	374
Denis A. Kurochkin, Dmitry A. Shtein, Andrey V. Geist, Maxim F. Shandrin, Dmitry V. Korobkov	
13. Calculation of Energy Storage System Parameters	379
Sergey V. Kuchak, Petr A. Bachurin, Sergey A. Kharitonov	
14. A Control Technique for Current Source Matrix Converter	384
Evgeny D. Baranov, Vladimir I. Popov, Nikita A. Sevostyanov	
15. Predictive Digital Current Programmed Control with Load Current Compensation for DC-DC Converters	389
Nikita A. Sevostyanov, Roman L. Gorbunov	
16. Electrical Modeling of the Spiral Bus Bar	395
Maxim E. Komnatnov, Talgat R. Gazizov	
17. Multiport Push-Pull/S3R/S4R DC-DC Converter for Spacecraft Power Systems	400
Dmitri A. Shtein, Sergey V. Klassen, Tatiana S. Klassen, Viacheslav S. Konyakhin	

18. Investigation of Experimental Imitative Testing of Vacuum Circuit Breaker	407
Muhammad Saqib, Yubin Xu, Shojaa Ayed Aljasar, Francis N.J, Francis N.S	

Section VI. Medical Electronics

Section Chair: **Gennady S. Evtushenko**

1. Portable Device for Express Assessment of Functional State of Hemostasis System	414
Egor L. Zhukov, Fedor A. Gubarev, Ivan I. Tyutrin, Yuliya V. Dyachenko	
2. Algorithm for Assessing the Quality Compensation of the Skin-electrode Contact by Capacitive ECG Sensors	418
Artem I. Morenetz, Boris N. Pavlenko, Inna A. Lezhnina, Arman A. Boyakhchyan, Gennadiy S. Evtushenko	
3. Two-Frequency Speckle Analysis of Plasma Clotting Time	423
Iuliia D. Liushnevskaya, Fedor A. Gubarev	
4. Improving the Information Reliability in Medical Information System Based on Multi-agent Technology	427
Oleg N. Bodin, Anatoly G. Ubiennykh, Oksana E. Bezborodova, Sergei A. Kharitonov, Svetlana V. Vorob'eva, Andrey Yu. Bodin	
5. Air Flow Sensor Based on Environmental Sensor BME280	432
Gleb V. Shevchenko, Nikita A. Glubokov, Anton V. Yupashevsky, Anna S. Kazmina	
6. The Effect of Humidity on the Readings of Carbon Dioxide Sensors	436
Anton V. Yupashevsky, Anna S. Kazmina, Konstantin A. Metsler, Gleb V. Shevchenko, Nikita A. Glubokov	
7. A Bionic Approach to the Construction of a Voice Control System in Emergency Conditions	440
Gulmira K. Berdibaeva, Oleg N. Bodin, Oksana E. Bezborodova, Andrew N. Spirkin, Baianbai Nurlan, Kasymbek A. Ozhikenov	
8. Portable Cardioanalyzer with Registration of Multiply Leads of Electrocardiac Signals	445
Oleg N. Bodin, Mikhail N. Kramm, Ruslan F. Rakhmatullov, Fagim K. Rakhmatullov, Maxim I. Safronov, Andrey Yu. Bodin	
9. Analysis of Acoustic Parameters of the Speech Apparatus	450
Yana A. Berg, Anastasia V. Nenko, Daria V. Borovikova	
10. Device for Reliable Localization of Skin Surface Active Zones in Inert Gases Environment	454
Aleksandr M. Fateev, Vyacheslav V. Marauskas, Liliya I. Lisitsyna, Leonid G. Navrotsky, Valerii I. Yudin	

Section VII. Robotics, Mechatronics and Automation

Section Chair: **Oleg V. Nos**

1. Shaping of Setpoint Signal for Temperature Controller	458
Vladimir A. Grinkevich	
2. Peculiarities of Equipping an Unmanned Medical Aerial Vehicles During Search and Rescue Operations	464
Nurlan A. Bayanbay, Kasymbek A. Ozhikenov, Yerkebulan A. Tuleshov, Oksana E. Bezborodova, Oleg N. Bodin, Andrey N. Spirkin	
3. Synthesis of Induction Motor Adaptive Field-Oriented Control System with the Method of Signal-Adaptive Inverse Model	470
Olga E. Paul, Ekaterina S. Kucher	
4. The Simplified Control Technique for PMSM Torque Ripple Reduction	475
Oleg V. Nos, Dmitri A. Shtein, George S. Leus, Natalja I. Nos, Ekaterina E. Abramushkina, Egor A. Ignatev	
5. A Method for Stabilizing the Rotor Speed of a Vortex-type Wind Power Plant using Two Variable Elements of its Geometry	482
Vladimir A. Kostyukov, Mikhail Yu. Medvedev, Dmitrii D. Pavlenko, Andrey M. Mayevsky, Nikolay K. Poluyanovich	