

2021 International Scientific and Technical Engine Conference (EC 2021)

**Samara, Russia
23-25 June 2021**



**IEEE Catalog Number: CFP21AK4-POD
ISBN: 978-1-6654-4852-9**

**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:	CFP21AK4-POD
ISBN (Print-On-Demand):	978-1-6654-4852-9
ISBN (Online):	978-1-6654-4851-2

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

Methodology for Multilevel Design of Combustion Chambers for Gas Turbine Engines	1
<i>Y. B. Aleksandrov, T. D. Nguyen, B. G. Mingazov</i>	
Gas Turbine Design Analysis and Optimization with Novel Hybrid Model Using Classical Physics and Machine Learning.....	9
<i>Aurthur Vimalachandran, Thomas Jayachandran, Andrey Yurievich Tkachenko, Hewa Hussein Omar, Krishnakumar Aruljothi</i>	
Methodology for the Analysis of Moment Characteristics of Radial-Thrust Two-Row Bearing Being Under a Combined Load.....	18
<i>V. B. Balyakin, D. E. Dolgikh, E. G. Krylov</i>	
Calculation of GTE Parameters Taking the Uncertainty of the Initial Data and Verification of Stochastic Results into Account	24
<i>Oleg V. Baturin, P. Nicolalde, Andrei U. Tkachenko, Anastasia S. Volkova, Alexandra S. Podgornova, Yulia D. Novikova</i>	
Application of Si-NaN ₃ -Na ₂ SiF ₆ - C Powder Mixture Combustion for Synthesis of Highly Dispersed Si ₃ N ₄ -SiC Ceramic Composition.....	31
<i>G. S. Belova, Yu. V. Titova, A. P. Amosov, D. A. Maidan</i>	
Analysis of Ways to Improve the Speed of a Diesel Injector for the Implementation of Split Injection.....	37
<i>V. V. Biryuk, S. S Kayukov, A. A Gorshkalev, Yu. D. Lysenko, V. A. Zvyagintsev</i>	
Development of a Methodology for Calculating the Working Process of a Small-Size Two-Stroke Internal Combustion Engine.....	42
<i>V. V. Biryuk, M. O. Zakharov, A. A Gorshkalev, V. L. Larin</i>	
Development of a Test Bench for Determining the Power Characteristics of a Small-Size Two- Stroke Internal Combustion Engine	49
<i>V. V. Biryuk, M. O. Zakharov, A. A Gorshkalev, V. L. Larin</i>	
Experimental Investigation of Thermocompressor.....	55
<i>Evgeny Blagin, Sergey Korneev, Alexey Lopatin, Dmitry Sarmin</i>	
Modeling of Charge and Discharge Processes of Experimental Unit of Heat Accumulator	60
<i>Evgeny Blagin, Ivan Uskov, Elizaveta Kuznetsova, Vladimir Biryuk</i>	
Modified Method of Calculation of the Flows in Areas with Moving Boundaries	65
<i>I. P. Boychuk, A. V. Grinek</i>	
Improving the Efficiency of Low-Temperature Power Plants by Selecting the Optimal Working Fluid of the Auxiliary Circuit	70
<i>Eliseev Ivan, Tochenov Vladislav, Panshin Roman</i>	
Double Bypass Turbojet Engine Analysis.....	77
<i>Kristina Bezborodova, Evgeny Filinov</i>	
Parametric Diagnostics of the Condition of a Dual-Flow Double-Shaft Turbojet Engine Using Neural Network Simulation of the Operating Process.....	82
<i>Gishvarov Anas, Rahirinjatovo Celestin</i>	

Selection Method of the Optimal Parameters of the Aircraft Engine Particle Separator.....	87
<i>Gishvarov Anas, Rahimov Abdusattor</i>	
Development of the Steam Compressor Unit for a Desalination Plant.....	90
<i>A. A Gorshkalev, E. A. Marakhova, S. S. Korneev, V. V. Urlapkin</i>	
A Hybrid Method for Prediction the Sauter Mean Diameter (D32) of Kerosene Sprays of Pressure-Swirl Atomizers of Small Size Gas Turbine Engines.....	94
<i>Gurakov N. I., Matveev S. G., Zubrilin I. A., Didenko A. A., Hernandez Morales M., Yastrebov V. V., Yakushkin D. V.</i>	
A Methodology for Calculating the Properties of Aircraft Kerosene Surrogates that Effect the Atomization and Evaporation Characteristics	98
<i>Hernandez Morales M., Zubrilin I. A., Matveev S. G., Gurakov N. I., Didenko A. A., Anisimov V. M., Tsapenkov K. D.</i>	
Development of Aviation Kerosene TS-1 Surrogate by Combustion Characteristics	103
<i>D. V. Idirsov, I. A. Zubrilin, S. S. Matveev, S. G. Matveev, M. D. Gamirullin, R. A. Azimov, A. M. Sipatov</i>	
Laminar Burning Velocity of the Surrogate of Aircraft Kerosene and Its Components.....	109
<i>D. V. Idirsov, S. S. Matveev, S. G. Matveev, A. D. Popov, A. N. Belousov</i>	
On the Methods of Implementing the Turbofan Core Test Process Control Logic with Simulation of the Target Thermodynamic Parameters in the Conditions of the Engine OEM's Facility	113
<i>Alexander Inozemtsev, Igor Gribkov, Boris Kavalarov, Igor Shmidt, Ivan Bakhirev, Ilya Ziyatdinov</i>	
Choice of Gas Temperature at Turbopump Turbine Inlet	119
<i>Ivanov Andrei</i>	
Various Factors Influence of Heat-Shielding Material Decomposition on Flow Rate Coefficient of Recessed Nozzle	123
<i>A. N. Kirillova, A. N. Sabirzyanov, V. V. Kuzmin</i>	
Computer-Aided Design, Selection of Parameters, Materials and Construction, Analysis of Control Programs for Aircraft Jet Engines at the Early Stages of Development.....	128
<i>D. A. Akhmedzyanov, A. E. Kishalov</i>	
Analytical Solutions to Heat Conduction Problems with Time-Variable Boundary Conditions.....	137
<i>R. M. Klebleev, A. V. Pashin, A. E. Kuznetsova, T. B. Tarabrina</i>	
Gate Location Optimization of Injection Molded Aerospace Brackets Using Metaheuristic Algorithms.....	142
<i>Evgenii Kurkin, Evgenii Kishov, Oscar Ulises Espinosa Barcenas, Vladislava Chertykovtseva</i>	
Computer Simulation of a High-Speed Forming of the Metal-Polymer Composite Material	148
<i>Lihui Lang, Dmitrii Chernikov, Yaroslav Erisov, Sergei Surudin, Aleksandr Kuzin</i>	
Combustion Synthesis of Ti ₃ AlC ₂ Porous Skeleton with Spontaneous Infiltration by Aluminum Melt for Ti ₃ AlC ₂ -Al Cermet Preparation	155
<i>E. I. Latukhin, E. R. Umerov, A. P. Amosov</i>	
Preparation of Ti ₃ SiC ₂ -Sn Cermet by the Combustion Synthesis of Ti ₃ SiC ₂ Porous Skeleton with Subsequent Spontaneous Infiltration by Tin Melt	162
<i>E. I. Latukhin, E. R. Umerov, A. P. Amosov</i>	

Development and Research of the Design of a Heat Exchanger for an Evaporative System Based on Thermoelectric Generators	167
<i>A. L. Lopatin, D. V. Sarmin, E. V. Blagin, D. A. Uglanov</i>	
Experimental Model of an Electric Power Plant for Small UAV's Automatic Control Systems.....	172
<i>O. E. Lukyanov, O. U. Espinosa Barcenas, D. V. Zolotov</i>	
Energy Efficiency Index of Industrial Energy Consumers for Achieving the Sustainable Development Goals	176
<i>Gennadii Miatishkin, Anna Mironenkova</i>	
Verification of the Energy Efficiency Index of Industrial Energy Consumers with GRI and NASDAQ Reporting and Indicators.....	181
<i>Gennadii Miatishkin, Anna Mironenkova</i>	
On the Possibility of Creating Small Detonation Aero Engines Based on Jet Initialization of Detonation	186
<i>K. V. Migalin, I. P. Boychuk</i>	
Vibroacoustic Modeling of a Compressor Pipeline System	192
<i>Mironova Tatiana</i>	
Numerical Investigation of the Pulse Tube Engine	197
<i>S. O. Nekrasova, E. F. Bahvalova, D. V. Nistotskiy</i>	
Analysis of 16-Stage Compressor Working Process for an Industrial Gas Turbine Uint.....	202
<i>Vladimir O. Nepomnyaschiy, Grigorii M. Popov, Maxim G. Miheev, Evgenii E. Fisher, Alexey K. Vorobyev, Vasili M. Zubanov, Evgenii S. Goriachkin</i>	
Simulation of Combustion Processes and Emission Characteristics in a Swirling Flow.....	207
<i>T. D. Nguyen, Y. B. Aleksandrov, B. G. Mingazov</i>	
Influence of Various Factors on the Optimal Values of the Working Process Parameters and the Efficiency Indicators of the Turbofan Engine with Heat Exchanger.....	214
<i>Hewa Hussein Omar, Venedikt Stepanovich Kuz'Michev, Evgeny Pavlovich Filinov, Aurthur Thomas Jayachandran</i>	
Comparative Analysis of Neural Network Architectures for Industrial Machine Vision System	220
<i>Ekaterina Pechenina, Vadim Pechenin, Michael Bolotov</i>	
The Need to Study Non-Linear Hydro-Mechanical Systems in Generalized Parameters	224
<i>Petrov Pavel Valeryevich</i>	
ANSYS/LS-DYNA Simulation-Based Study of Buckling Caused Deep Drawing Limiting Parameters	229
<i>Igor Popov, Dmitry Nikonov, Elena Demyanenko, Konstantin Nikolenko</i>	
Joint Aerodynamics and Strength Optimization of a Single-Stage Uncooled Turbine with a Shroud Platform.....	233
<i>Grigorii M. Popov, Evgenii S. Goriachkin, Oleg V. Baturin, Anastasia I. Korneeva, Igor N. Egorov, Tatyana O. Krivonogova</i>	
Search for Rational Settings of a Numerical Model of for Studying Film Cooling in Axial Turbines.....	241
<i>Grigorii M. Popov, Andrew A. Volkov, Ivan A. Kudryashov, Valery N. Matveev, Oleg V. Baturin</i>	

Calculation of Dynamic Characteristics of Adaptive Helmholtz Resonator Cavity for Hydraulic Systems.....	246
<i>Danila Radin, Georgy Makaryants, Dmitriy Borisov</i>	
Problems of the Commercialization of Intellectual Property at the Rocket and Space Industry in Russia	250
<i>N. A. Razveykina, E. G. Shikhanova, E. S. Shkodina</i>	
Thermodynamic Evaluation of Carbon Allotropic Form Effect on Titanium Carbide Phase Combustion Synthesis in Aluminum Melt	255
<i>A. D. Rybakov, A. R. Lutz, D. V. Zakamov, A. P. Amosov</i>	
Mathematical Model of Polyurethane Foam Acoustic Characteristics.....	260
<i>Safin Artur, Aleksandr Kuznetsov, Kirill Afanasev, Alexey Pantyushin</i>	
Estimation of Measurement System Characteristics Influence on the Industrial Robot Displacement Assessment in the Incremental Forming Process	263
<i>Nadezhda A. Sazonnikova, Vladimir N. Ilyuhin, Sergey V. Surudin, Nikita N. Svinarov</i>	
Dynamics of Spray Combustion in Diesel Engine-Like Conditions	270
<i>Elena Shchepakina, Vladimir Sobolev, Sergei S. Sazhin</i>	
Combined Method for Prediction of Carbon Monoxide Emission from Gas Turbine Combustion Chambers.....	276
<i>A. R. Kuthumukhamedov, D. V. Skiba, F. G. Bakirov</i>	
The Effect of Surface Roughness on the Heat Exchange Coefficient of Generator Gas and Nitrogen in an Additive Technology Liquid-Propellant Engine's Supercharger	280
<i>Smekalkin A. S., Ivanov A. V.</i>	
Three-Dimensional Periodic Thermoelastohydrodynamic (PTEHD) Modeling of Hydrodynamic Processes of a Thrust Bearing	283
<i>N. V. Sokolov, P. E. Fedotov, M. B. Khadiev, E. M. Fedotov</i>	
The Emotional Burnout Syndrome Development Among Students of a Technical University	290
<i>Oleg Sviderskiy, Viktoriya Rovenska, Iryna Smyrnova</i>	
Exploring the Possibility of Synthesis of Tin-SiC Ultrafine Powder Composition During Combustion in Si-Ti-NaN ₃ -(NH ₄) ₂ TiF ₆ -C System	299
<i>Titova Yu. V., Amosov A. P., Maidan D. A., Belova G. S., Samboruk A. R.</i>	
Selection of the Optimal Circuit and the Calculated Study of the Parameters of the Cryogenic Power Plant of the UAV	305
<i>Tremkina Olga, Uglanov Dmitry, Adenane Hamza</i>	
Research of Jet-Cavitation Fluid Mass Flow Stabilizer.....	309
<i>D. V. Tselischev, S. Y. Konstantinov, V. A. Tselischev</i>	
Selection of the Optimal Method of Accumulation and Storage of Electricity	318
<i>Dmitry A. Uglanov, Anastasia S. Filanova, Naresh Kedam</i>	
Application of Additive Technologies in the Design and Creation of Electrical Machines	323
<i>V. E. Vavilov, F. R. Ismagilov, E. I. Zaynagutdinova</i>	
Numerical Simulation of Flow and Heat Transfer Characteristics of Asymmetric Blade Leading Edge Structure	330
<i>Wang Lingyang, Mao Junkui, Wang Feilong</i>	

A Low-Temperature Thermoacoustic Engine 340
E. A. Zinovyev, S. O. Nekrasova, G. V. Vorotnikov, A. I. Dovgyallo

Experimental Investigation of the Combustion of a Pre-Vaporated Surrogate of Aviation Kerosene
in a Lab-Scale Combustion Chamber 345
*Kolomzarov O. V., Abrashkin V. Yu., Zubrilin I. A., Matveev S. G., Gamirullin M. D., Azimov
R. A., Sipatov A. M*

Author Index