2021 14th International Conference Management of Large-Scale System Development (MLSD 2021)

Moscow, Russia 27 – 29 September 2021



IEEE Catalog Number: ISBN:

CFP21GAE-POD 978-1-6654-2965-8

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:	CFP21GAE-POD
ISBN (Print-On-Demand):	978-1-6654-2965-8
ISBN (Online):	978-1-6654-1230-8

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

Pg.	Authors	Article title
1	Abdulov A., Abramenkov A., Rusakov K., Shevlyakov A.	AEROBOT-2020 UAV Challenge: a Report
6	Abdulova E.	Data Mining and Risk Potential Assessment
11	Abdulova E., Kalashnikov A.	Some Aspects of Critical Information Infrastructure Risk Management
16	Agaev R., Khomutov D.	Graph Interpretation of the Method of Orthogonal Projection for Regularization in Multiagent Systems
20	Akinfiev V.	Modeling the Expansion of the Production Capacity of Companies in the Oligopoly Market
25	Akinfiev V.	Choosing the Degree of Localization of Production Taking into Account the Interests of the Project Participants
30	Alekseev A.	Identification of Integrated Rating Mechanisms, Taking into Account the Preferences of a Group of Agents
35	Alyushin A., Arkhangelsky V.	Acoustic Monitoring of the Psycho-Emotional and Physical State of Operational Personnel in the Management of High-Risk Objects Based on Self-Learning Neuromorphic Systems
40	Alyushin A., Arkhangelsky V.	Fractal Neuromorphic Pattern Recognition Architecture for Experimental Physics
45	Andriyanov N.	Application of Factor Analysis and Neural Networks for Prediction in Taxi Service
50	Andryushin A., Neklyudov A., Yagupova J., Novitsky D., Shklovsky Yu.	Development of an Optimization Model for the Operating Modes of Heating Units under Conditions of Changing Energy Consumption Schedules
53	Antipov A., Krasnova S., Pivneva S.	Control of Electromechanical Plant under Uncertainty and State Variables Constraints
58	Arakelyan E., Pashchenko F., Mezin S., Andriushin A., Kosoy A.	Increasing the Intelligence of the Automated Process Control System by Managing the Current Energy Indicators of the TPP Equipment
63	Arakelyan E., Simakov K.	Features of Choosing the Optimal Operating Modes of an Autonomous Power Center Based on Gas Piston Units
68	Arsenyev-Obraztsov S.	Generation of Petrophysical Parameters for Forecasting of Oil and Gas Deposits Development, Digital Core and Multi-scale
73	Arutyunov A., Zhukovskiy S.	On The Existence of Minima of Differentiable Functions in Normed Spaces

77	Asratian R.	Deterministic Approach to Information Queries Parallel Batch Processing Modelling and Evaluating
82	Balabanov A., Kasimov A., Popov A., Fateev V.	MNM-Modelling and Creating Designs of Discrete Microfluidics
86	Belinskaya Yu.	Application of the Covering Method for Trajectories Design for Car-like Robot
91	Bezrodniy A., Rezchikov A.	Hydrogen Supply Net Control for Transport Branch of Economy
96	Bezrodniy A., Rezchikov A., Dranko O.	Algorithms to Develop H ₂ Filling Station Nets
101	Blagodarnyy Ye., Stepanov K.	The Express Valuation Model: Case of FAAMG Companies
106	Bogdanov S., Bogdanova T., Zvyagintsev N.	Development of a Large-Scale Holding for Servicing World-Class Oil and Gas Projects
111	Bogomolov A., Kushnikov V., Ivaschenko V., Tolobaev I.	Concerning Analysis and Control of Deviations of Economic Indicators of Countries Depending on Development of Hydrogen Power Engineering
116	Borisova L., Zhukova G.	Regional Migration in Russia: Dynamics, Features, Expectations
121	Budynkova E., Baybulatov A.	On Assignments Verification During the ICS Databases Lifecycle
125	Byvaykov M.	Synchronization of Reserved Information in Large-Scale Control Systems for APCS of NPP
130	Chadeev V., Aristova N.	Analysis of the Efficiency of Automation Control at the National Level
134	Chkhartishvili A., Gubanov D.	A Study on the Control of the Dynamics of Multidimensional Opinions in Social Networks
139	Chkhartishvili A., Gubanov D., Kozitsin I.	COVID-19 Information Consumption and Dissemination: A Study of Online Social Network VKontakte
144	Danik Yu., Dmitriev M.	Feedback Control Algorithms for Some Classes of Nonlinear Systems with a Parameter at Finite Interval
149	Devyatkov T., Devyatkov V., Gabalin A., Shuvalov K.	BIM Models Enhancement Through Simulation Modeling
154	Diane S., Lesiv E.	Neural-based Visual Odometry Trained in a Virtual Enviroment for a Mobile Robot Navigation
159	Dranko O., Bogomolov A., Dvoryashina M., Yandybaeva N.	Stress Testing of Backbone Enterprises in Russia: a Case of Retail Trade
163	Druzhinin Yu., Sokolov V.	Distributed Monitoring System of Discharges of Enterprises-users of Natural Resources into the River Basin to Minimize Environmental Damage

168	Dudnikov E.	Structure of Hyperloop Systems with Side Branches
172	Ereshko F., Gorelov M.	Hierarchical Games with Restrictions on the Amount of Information Transmitted
177	Ermolaev A., Kuvichko A., Latipov A.	Design of Optimal Well Positions on Gas Fields
181	Fedyanin D.	On Control for Reaching a Consensus in Multiagent Systems with Bounded Opinion Updates
186	Filimonyuk L.	Forecasting Models for Passengers Evacuation's Characteristics from an Airplane in Emergencies on the Ground
190	Gasanov I., Ereshko A.	Overview of the Software Complex for High- Frequency Exchange Trading on the Stock Market
194	Gertsik Yu., Omelchenko I.	Opportunities and Challenges of Initiative- Innovative Cluster Structures within Large-Scale Systems of the Medical Industry and Healthcare
198	Giliazova A.	Classification of Texts Using a Vocabulary of Synonyms
203	Ginsberg K.	Toward the Foundations of Methodology for the Practical Use of Structural Identification Mathematical Methods in Conditions of Prior Structural Uncertainty
208	Glumov V.	Prediction and Stabilization of Elastic Oscillations of a Large Space Construction
213	Golev A., Ogorodnikov O.	Algorithms for Informative Features Extraction in the Problem of Data Mining on Item Related State Evaluation
218	Gorelik V., Zolotova T.	Stochastic Principles of Optimality in Games with Nature and Their Application in Investment Management
223	Gorelov M.	Hierarchical Games with Limited Information about the Environment
228	Gorodetskaya O., Gobareva Ya., Koroteev M.	Forecasting Time Series in the Banking Sector Using a Machine Learning Pipeline
233	Grebenyuk E.	Algorithms for Detecting Changes in the Properties of Non-Stationary Processes in the Monitoring Mode
238	Grebenyuk G., Kalyanov G., Kovalyov S., Krygin A., Lukinova O., Nikishov S.	Technological Infrastructure Management Models and Methods Based on Digital Twins
243	Grebenyuk G., Lubkov N., Roschin A., Sereda L.	Analysis of the Synergistic Effects of Failures in Complex Network Structures

248	Grishaev S., Rusyaeva E.	Management and Monitoring of Rare Earths Circulation in the Economy
253	Gulyukina S., Utkin V.	Synthesis of Invariant Systems under Uncoordinated Disturbances Based on the Theory of Sliding Modes
258	Gusev V., Isaeva N.	Statistical Expert Method for Monitoring an Enterprise's Financial Activities
263	Iskhakov A., Meshcheryakov R., Iskhakov S.	Problems of Using Compromise Indicators for Proactive Threat Detection in Robotic Systems
268	Ismailov Zh., Kononov D.	New Silk Road: Modeling the Interaction of the Logistic Process Participants on the Railway Transport
273	Ivanyuk V., Shuvalov K.	Neural Network-Based Methods for Forecasting Financial Time Series
277	Ivanyuk V., Tsvirkun A.	Time Series Analysis and Financial Asset Forecasting Methods
281	Jharko E.	Digital Twin of the Technological Process of the NPP Power Unit
286	Jharko E.	Some Aspects of Quality Assurance in the Development of Digital Systems
291	Kalashnikov A., Anikina E.	Management of Risks for Complex System Based on a Generalized Arbitration Scheme
296	Kamenev I.	Optimal Control in Agent-Principle Problems for the Quasi-Public Sector
300	Kantimirov S., Serebryansky S.	On the Issue of Weight Design of Aircraft on a Digital Platform in a Single Information Space of the Product Life Cycle
305	Karpov A., Klochkov V.	Modelling of the Applied Research Diversification in the High-Tech Industry
310	Khablov D.	Autonomous Navigation for Control of Unmanned Vehicles Based on Odometers and Radar Sensor
315	Khamutova M., Kushnikov V.	Models and Algorithms for Managing the Process of Eliminating the Flood Effects at Flood-Prone Objects and Areas
319	Khobotov E.	Selection of Equipment for Modernization of Enterprises with Conveyor Assembly of Products
324	Khorshev A., Solyanik A.	Adaptation of Capacity Expansion Optimization Models Taking into Account Heterogeneous Requirements for Power Industry Decarbonization
329	Kiselev V.	Choosing an Agricultural Insurance Strategy

333	Kleparskiy V., Sheinis V.	Long-Term Development of Regions: the Historical Basis and Activity of the Regional Authorities
336	Kokunko Yu., Krasnova S.	Nonlinear Control Design for Path Following Stabilization of a Wheeled Robot under the Action of an External Uncontrollable Disturbance
342	Kononov D., Furugyan M.	Effective Means of Regional Management: Optimal Use of Heterogeneous Resources
347	Korolev A., Egorov I.	Tools and Methods for Functional Analysis of Complex Technical Systems
352	Kotyukov A., Pavlova N.	Equilibrium in Market Models
357	Kozlov A., Noga N.	Applying the Methods of Regression Analysis and Fuzzy Logic for Assessing the Information Security Risk of Complex Systems
362	Krygin A.	Analytical Methods for Minimizing the Cost of Repair Work on Pipeline Networks in the Formation of a Digital Double of Infrastructure
366	Kulba V., Medennikov V.	Mathematical Model of Managing the Agricultural Holdings in Building a Digital Platform
371	Kulba V., Somov S.	Data Replication in Ad-Hoc Mobile Networks MANET
376	Kulba V., Somov S.	Placing Replicas of Data Arrays in Dynamic Distributed Systems
380	Kulida E., Egorov N., Lebedev V.	Comparison of Two Algorithms for Solving the Problem Aircraft Arrival Sequencing and Scheduling
384	Kurako E., Orlov V.	Threat Comparison for Large-Scale Systems Using Different Browsers
389	Kushnikova E., Ivaschenko V., Dvoryashina M.	Coordination of the Functional Structure of the Decision Support and Management System
394	Lebedev V., Kulida E.	Features of the Intelligent Interface of the Aircraft Crew
398	Lepekhin I., Golubev P., Promyslov G., Semenkov K.	Performance Measurement and Validation of the Distributed Digital Control Systems
403	Lisitsyn A., Nikitina M., Chernukha I.	Product Quality and Safety Management in LargeScale Systems
407	Livchits V., Mironova I., Tischenko T., Frolova M., Shvetsov A.	Risk Accounting in Calculations of Public Efficiency of Large-scale Infrastructure Projects
411	Lukatskii A.	A Software Complex of Preparation for Solving a Multilinear Programming Problem
416	Lukyanov A.	Optimization of Shale Oil Development Based on a Two-zone Economic Model

		SDDRE Based Approximate Solution in
420	Makarov D.	Trajectory Tracking Control Problem for a Model of Two-Wheeled Differentially Driven Mobile Robot
425	Makarov D., Sobolev V.	Decomposition of Multiple Time-Scale Systems
430	Makarov V.	Lada Car Sales Models on the Russian Market
435	Malakhov V., Dubynina T.	Analysis of the Heterogeneity of Russian Regions in Terms of GRP and Population Income
440	Matkovskaya Ya.	Ecosystem Business Models: Methodological Problems of Identification and Some Methods for Describing Their Scaling Processes
445	Medennikov V., Flerov Yu.	Analysis of the Russian Agricultural Research Organizations' Digital Footprint
450	Mestcheryakov A.	Safety and Quality of Air Criteria in Objects with Artificial Human Environments
454	Mezin S., Kosoy A., Pashchenko F., Kudinov I.	Integration of Optimization Algorithms into the Software of Modern Program and Technical Complexes
459	Mikhalskii A., Novoseltseva J.	Selection of Personalized Parameters of the Object Model in a Closed Control System of the Blood Glucose Level
463	Ogorodnikov O.	Multi-Criterion Optimisation in a Problem of Preliminary Calculation of Maneuverable Aircraft Characteristics in the Presence of the Parameters with Epistemic Uncertainty
468	Panin V., Novikov P., Podorin A., Lakhankin E., Dmitriev E.	Predictive Modeling of Railway Transportation for the Medium-Term Period with Forecasting of Production and Economic Indicators
473	Paolicelli P., Tregub I., Byvshev V.	Analysis of the Impact of CAMELS Framework and Macroeconomic Indicators on the Italian Cooperative Bank's Financial Performance
478	Pavlovskiy I.	Transformation of Big Terminological Text into a Binary Homogeneous Oriented Network of Terms
483	Petrov A.	Is Inoculation Effective against Fake News? A Mathematical Model
487	Petrov A., Zheglov S., Kruchinskaia E., Akhremenko A.	Modeling Street Protests: Turnout Dynamics and Government Response
492	Philippov I., Yureskul E., Stukal D., Akhremenko A.	Modeling Bot Activity in the Online Political Communication
497	Pilnik N., Ujegov A.	The Use of Relaxation of Complementary Slackness Conditions for Jointing in General Equilibrium Models

502	Poltavsky A., Rusyaeva E.	Intellectualization of Models for Monitoring Objects as Part of Complexes of Unmanned Aerial Vehicles: Integration of Analysis Methods
507	Promyslov V., Promyslova O.	DoS Attack Prevention Using the Static Window Flow Control in Sequent Connected Devices
511	Raikov A.	Convergent Ontologization of Collective Scientific Discoveries
516	Romancheva N., Krivopalov D., Yurkevich E.	Calculation Algorithms for the Probability of Failure-Free Operation of a Large-Scale System with a Minimum Required Number of Heterogeneous Elements of the Loaded Reserve
521	Rozhnov A.	Development and Research of Hybrid Intelligence Components Based on the Quadrant Enabled Delphi Method with the Associated Application of the Data Envelopment Analysis
526	Safina E., Tikhonova A., Menshikova O., Yaminov R.	Studying Collective Choice Influence on Laboratory Participants' Individual Actions
530	Salnikov A., Stepanova I., Gudkova T., Batov A.	Application of the Modified Method of S-Approximations within the Framework of the Structural-Parametric Approach for the Construction of Regional Analytical Models of the Magnetic Field of Mars
533	Saltykov S.	Analysis of Decrease in Accuracy of Two-tier Trees without Using Feature Selection
538	Savushkin S.	Linguistic Model of Transportation Services Catalog
543	Serebryansky S., Nastas K.	Configuration Management for Unmanned Aircraft Basic Systems at the Different Stages of Its Lifecycle
548	Shchepkin A.	Financing Mechanisms with Stochastic Cost Information
553	Shevshenko V.	Development of the Basic Concepts of N.N. Moiseev and Yu.B. Hermeyer about Social Processes in Operational Game Scenario Modeling
558	Shiroky A., Burkova I., Burkov V.	The Coordinated Planning Methods in Hierarchical Organizations
562	Sizykh N., Sizykh D.	Research of the Stock Exchange Features Concerning Their Influence on Stock Quotes of Companies from the Various Sectors
566	Skiba A., Skiba N.	Profit Maximization in a Gas Field Model
571	Smaglichenko T., Smaglichenko A., Sayankina M., Chigarev B.	Seismic Anomalies in the Geothermal District Revealed by the Relaxation Algorithm of Selected Coordinate Descent

576	Sokolov E., Kostyrin E.	Economic Effect of Managing the Development of the Domestic Healthcare System on the Basis of Medical Savings Accounts
581	Solomatin A.	Economic and Mathematical Model of a Group of Gas Fields
586	Solovyev A., Valuev A.	Optimal Synthesis Method for Signalized Intersection of Urban Highways with Route Branching
591	Stepanov V.	Data Exchange Module Implementation for NPP APCS Gateway between Upper Unit Level System and Lower Level Systems
594	Stepanovskaya I.	Large-scale Organizational and Technical Systems Sustainable Development Concept
598	Sytov A., Vakhranev A., Ereshko F.	Enterprise Digital Twin Research
603	Tarasov A.	Features of the Innovation Modeling of the Russian Gas Industry
608	Terentyev A.	Chain of Digital Data Blocks Linked by a Numeric Linear Block Correction Code, as an Alternative to the Blockchain Technology
613	Titov A.	Complexity Theory and a General Mathematical Approach to the Formal Description of the Tasks of Managing Complex Systems
618	Tkacheva O., Vinogradova M., Utkin A.	Recovery Methods of Unmeasured Variables for Biological Models
622	Topka V., Tsvirkun A.	Indicative Time Planning in Strategic Goal Programs for the Development of Complex Large-Scale Systems
626	Troyanovskiy V.	Economic Analysis of One Type of Criminal Activity
630	Tsvirkun A., Rezchikov A., Dranko O., Stepanovskaya I.	Approach to Building a Model Complex for Managing the Development of Hydrogen Energy
635	Tsyganov V.	Complex of Models for Strategic Management of the Development of Large Transport Infrastructure
640	Tsyganov V.	Supervised Learning in Large Transport Holding
645	Tunitsky D.	On Solvability of Second-Order Semilinear Elliptic Equations on Spheres
649	Turovskii Ya., Borzunov S., Vakhtin A.	Estimation Method of Medical and Biological Signal Features in "Human-Computer" Interface Systems
653	Valuev A.	Probabilistic Modeling of Traffic Flows through Signalized Intersection with Branching Routes

658	Veresnikov G, Skryabin A.	Feature Selection Algorithms for Forecasting Technical Condition of Electromechanical Actuator
663	Veresnikov G.	Multi-Variant Simulation in the Preliminary Design of Technical Objects under Parametric Uncertainty
668	Veselov F., Erokhina I., Nikulina E.	Spot Prices Modeling Changes on the Wholesale Electricity Market in Russia with the Introduction of Carbon Payments as an Economic Incentive for the Power Industry Decarbonization
672	Veselov F., Solyanik A.	Modeling of Carbon Payment Impacts on Electricity Prices and Possibility for Mitigation of Negative Effects on Consumers
676	Vinogradova E.	Some Aspects of the Regional Structure of Investments
680	Vladova A.	Identification of the Railway Track Technical State
685	Vladova A., Vladov Yu., Yakimov A.	Visualizing Results of Promoting Campaigns
689	Vykhovanets V.	The Knowledge Description Language
694	Zatsarinnyy A., lonenkov Yu.	The Efficiency and Quality of Information Systems
699	Zatuliveter Yu., Fishchenko E.	Towards the Bicentric Architecture of Cybernetic Models of Sustainable Development of Large-Scale Systems
704	Zernov S.	Opportunities of Social Technology to Reduce the Negative Consequences of Informatisation
709	Zhmatov D.	Impulse Disturbance Filtration at Digital Substations
714	Zhmatov D., Ginsberg K.	Applied Method for Parametric Identification of Electrotechnical Objects in Digital Substations