

# **2023 5th International Conference on Problems of Cybernetics and Informatics (PCI 2023)**

**Baku, Azerbaijan  
28-30 August 2023**



**IEEE Catalog Number: CFP2391T-POD  
ISBN: 979-8-3503-1907-1**

**Copyright © 2023 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:    | CFP2391T-POD      |
| ISBN (Print-On-Demand): | 979-8-3503-1907-1 |
| ISBN (Online):          | 979-8-3503-1906-4 |

**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)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## TABLE OF CONTENTS

|                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------|----|
| Formation of the Flight Path of a Quadcopter Under Overland Monitoring by the Hybrid Modeling System .....                        | 1  |
| <i>Ali Abbasov, Ramin Rzayev, Tunjay Habibbayli</i>                                                                               |    |
| Shooting Method for Finding Cost Optimal Trajectory.....                                                                          | 5  |
| <i>Majid Abbasov, Artyom Sharlay</i>                                                                                              |    |
| On the Use of Delayed State Information for Optimal Control Synthesis.....                                                        | 8  |
| <i>Vagif Abdullayev, Samir Guliyev</i>                                                                                            |    |
| On a Loaded Optimal Control Problem with Multipoint Conditions .....                                                              | 11 |
| <i>Vagif Abdullayev, Soltanali Jafarli</i>                                                                                        |    |
| Monitoring of Indicators Ensuring Environmental Safety of Drinking Water.....                                                     | 14 |
| <i>Gulchin G. Abdullayeva, Sayyara G. Gidayatzada</i>                                                                             |    |
| Optimal Control Problem for Stochastic Delayed Switching Systems.....                                                             | 17 |
| <i>Charkaz Aghayeva</i>                                                                                                           |    |
| Exploring the Learning Potential of ELM from Finite Difference Solutions for Heat Equation.....                                   | 20 |
| <i>Muhammad Jalil Ahmad, Korhan Gunel</i>                                                                                         |    |
| On a Control Problem for a Variable Structure with Fractional Caputo Derivatives.....                                             | 23 |
| <i>Zhala Ahmadova</i>                                                                                                             |    |
| Computer System Concept of Self-Study, Testing and Knowledge Assessment .....                                                     | 26 |
| <i>Kamil Aida-Zade, Aynur Aliyeva</i>                                                                                             |    |
| The Problem of Control with Feedback of the Power of Moving Sources with Optimization of Measurement Points Heating of Plate..... | 29 |
| <i>Kamil Aida-Zade, Vugar Hashimov</i>                                                                                            |    |
| Development of Security Mechanisms in Cloud Based SCADA Systems .....                                                             | 33 |
| <i>Rashid Alakbarov, Mammad Hashimov</i>                                                                                          |    |
| Assessment of Society Based on the Analysis of the Behavior of Citizens on the Platform of Electronic Demography .....            | 36 |
| <i>Irada Alakbarova</i>                                                                                                           |    |
| CTI Challenges and Perspectives as a Comprehensive Approach to Cyber Resilience.....                                              | 40 |
| <i>Rasim Alguliyev, Babak Nabiyev, Konul Dashdamirova</i>                                                                         |    |
| An Intelligent System for Monitoring the Beginning of Malfunctions in Oil Wells .....                                             | 45 |
| <i>Telman Aliev, Gambar Guluyev, Asif Rzayev, Fakhrad Pashayev</i>                                                                |    |
| A Model for Optimization of Feature Extraction in Recognition Systems Based on Parallel Algorithms.....                           | 50 |
| <i>Araz R. Aliev, Elviz A. Ismayilov</i>                                                                                          |    |
| Decision-Making Technologies in Bridge Structure Monitoring Systems Based on the Noise Model .....                                | 54 |
| <i>Telman Aliev, Naila Musaeva</i>                                                                                                |    |

|                                                                                                                                       |     |
|---------------------------------------------------------------------------------------------------------------------------------------|-----|
| Performance Evaluation of Algorithms for Anomaly Detection Using Apache Spark .....                                                   | 59  |
| <i>Ramiz Aliguliyev, Tural Badalov</i>                                                                                                |     |
| Development of Labeling and Prediction System for Breast Cancer Detection.....                                                        | 62  |
| <i>Rumiyya Alili, Minura Hajisoy, Narmina Mahmudova, Nihat Abdullayev, Jamaladdin Hasanov</i>                                         |     |
| Existence of Invariants in Periods of Generalized Collatz Sequences.....                                                              | 66  |
| <i>Yagub N. Aliyev</i>                                                                                                                |     |
| Numerical Solution and High-Order Error Determination for the Problems with Non-Classical<br>Boundary Condition .....                 | 69  |
| <i>Aydin Aliyev</i>                                                                                                                   |     |
| Hybrid Prediction Method Using Experts and Models.....                                                                                | 74  |
| <i>Vugar Aliyev, Merab Pkhovelishvili, Natela Archvadze, Zurab Gasitashvili, Zaza Tsiramua</i>                                        |     |
| Methods of Data Mining and Their Industrial Applications .....                                                                        | 78  |
| <i>Yedilkhan Amirgaliyev, Beibut Amirgaliyev, Perizat Omarova</i>                                                                     |     |
| A Numerical Approach to the Problem of Optimal Control of Vibrational Processes.....                                                  | 82  |
| <i>Jamila Asadova</i>                                                                                                                 |     |
| Problem on a Determination of Places and Capacities of Sources in the Hyperbolic Systems .....                                        | 87  |
| <i>Yegana Ashrafova, Sevinc Rasulova</i>                                                                                              |     |
| A Depth-First Search-Based Algorithm for the Minimization of the Largest Connected Component<br>in Networks .....                     | 92  |
| <i>Yesim Aygöl, Omur Ugurlu, Urfat Nuriyev</i>                                                                                        |     |
| Analysis of the Use of Methods and Feature Groups for Author Recognition on the Example of<br>Texts in the Azerbaijani Language ..... | 96  |
| <i>Rustam Azimov</i>                                                                                                                  |     |
| On the Solvability of a Time Nonlocal Inverse Coefficient Problem for the Equation of<br>Longitudinal Wave Propagation .....          | 100 |
| <i>Elvin Azizbayov, Yashar Mehraliyev</i>                                                                                             |     |
| Evaluating the Performance of Different Machine Learning Algorithms for Android Malware<br>Detection .....                            | 103 |
| <i>Elshan Baghirov</i>                                                                                                                |     |
| Simulation the Power Line Mode Using Equations with Distributed Nonlinear Conductivity .....                                          | 107 |
| <i>Ashraf Balametov, Elman Khalilov, Tarana Isayeva</i>                                                                               |     |
| Modelling Disease – Drug Networks with Petri Nets.....                                                                                | 111 |
| <i>Rza Bashirov</i>                                                                                                                   |     |
| Architectures for Processing Large Data Arrays in Distributed Systems Based on Open Source<br>Frameworks .....                        | 116 |
| <i>Olga Blinova, Oleg Kuprikov, Daniil Komanich, Ekaterina Gorina</i>                                                                 |     |
| Using Random Fuzzy Variables for RCPSP .....                                                                                          | 120 |
| <i>Aleksandr M. Bulavchuk, Daria V. Semenova</i>                                                                                      |     |
| An Improvement to the Hybrid Subgradient Method for Aircraft Maintenance Routing Problem .....                                        | 123 |
| <i>K. Gülnaz Bülbül, Refail Kasimbeyli</i>                                                                                            |     |

|                                                                                                                                                             |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Optimization of the Hyperbolic Type Differential Inclusions Described by Polyhedral Set Valued Mappings.....                                                | 126 |
| <i>Gülseren Çiçek, Elimhan N. Mahmudov</i>                                                                                                                  |     |
| Motion Control in Condition of Conflict and Uncertainty .....                                                                                               | 130 |
| <i>Arkadii Chikrii, Greta Chikrii</i>                                                                                                                       |     |
| Asymptotic Analysis of Retrial Queueing System MMPP/M/1 with Impatient Customers, Collisions and Unreliable Server .....                                    | 133 |
| <i>Elena Danilyuk, Daria Kuznetsova, Svetlana Moiseeva</i>                                                                                                  |     |
| Retrial Queueing System M[n]/M/1 with Feedback and Impatient Customers .....                                                                                | 137 |
| <i>Ekaterina Doroshenko, Ekaterina Titarenko</i>                                                                                                            |     |
| Evaluation of University Monitoring Criteria with Fuzzy AHP Method .....                                                                                    | 140 |
| <i>Hayrūnnisa Ergin, Efendi Nasibov</i>                                                                                                                     |     |
| Development of Satellite Attitude Controller with TRIAD and Particle Swarm Optimization Using Only Magnetic Actuators.....                                  | 143 |
| <i>Mehmet Fatih Ertürk, Chingiz Hajiye</i>                                                                                                                  |     |
| Development of an Interface for the Rapid Construction of Formal Context-Logical Queries for Searching for Information in Large Arrays of Information ..... | 148 |
| <i>Mais Farkhadov, Olga Blinova, Ekaterina Pankratova, Valentin Smirnov</i>                                                                                 |     |
| Underwater Wireless Communications Researching, Analysis and Comparison .....                                                                               | 151 |
| <i>Mais Farkhadov, Oleg Kuprikov, Daniil Komanich</i>                                                                                                       |     |
| Analysis and New Approaches to Solving the Problems of Integration of E-Science and E-Education Based on the Challenges of Industry 4.0 .....               | 155 |
| <i>Tahmasib Fataliyev, Hafiz Bayramov, Rena Mikayilova</i>                                                                                                  |     |
| Asymptotic Analysis of Two-Phase Queueing System with Service Rate Degradation and Heterogeneous Customers .....                                            | 160 |
| <i>Ekaterina Fedorova, Ivan Lapatin, Olga Lizyura, Alexander Moiseev, Anatoly Nazarov, Svetlana Paul</i>                                                    |     |
| Identification of the Parameter of the Single-Phase Flow Model in the Reservoir with the Power Law of Filtration.....                                       | 165 |
| <i>Khanlar Gamzaev, Sergey Leonov, Sevil Huseynzade, Sevinc Kerimova</i>                                                                                    |     |
| Combining GAN with Other Machine Learning Techniques for Improving Customs Fraud Detection .....                                                            | 168 |
| <i>Asif Ganbayev</i>                                                                                                                                        |     |
| New Key Exchange Protocol Based on Matrix Algebras .....                                                                                                    | 172 |
| <i>Vagif Gasimov, Nargiz Mammadzada, Jabir Mammadov</i>                                                                                                     |     |
| On Multiresource Queues with Multiserver Customers .....                                                                                                    | 175 |
| <i>Alexander Golovin, Alexander Romyantsev</i>                                                                                                              |     |
| Incorporating the Regional Dominance Strategy into Multi-Swarm PSO .....                                                                                    | 178 |
| <i>Iclal Gor, Korhan Gunel, Gulsum Isman</i>                                                                                                                |     |
| Control of Dynamic Systems with Lumped Parameters Based on Current and Delayed Feedback .....                                                               | 181 |
| <i>Samir Guliyev, Vagif Abdullayev</i>                                                                                                                      |     |

|                                                                                                                                          |     |
|------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Analysis of the Methods for Constructing Membership Functions Using Expert Data.....                                                     | 185 |
| <i>Punar Guliyeva, Rashad Ismibayli</i>                                                                                                  |     |
| Autoencoder-Based Feature Extraction for the Classification Tasks with Insufficient Dataset Size.....                                    | 188 |
| <i>Emil Guliyev, Nurhan Aliyev, Nihad Asgarov, Jamaladdin Hasanov</i>                                                                    |     |
| Optimal Control Problem with Coefficients for the Unstable Vibration Equation of an Elastic Plate .....                                  | 192 |
| <i>Hamlet Guliyev, Khayala Seyfullayeva</i>                                                                                              |     |
| Optimal Control Problem for Second Order Hyperbolic Equations with Non-Local Condition with<br>Control in Coefficients .....             | 196 |
| <i>Hamlet Guliyev, Hikmat Tagiyev</i>                                                                                                    |     |
| Q-Rayleigh Distributions: Properties, Estimation and Applications .....                                                                  | 199 |
| <i>Hasan Hüseyin Gül</i>                                                                                                                 |     |
| Development of Adaptive Control System Using Fuzzy – Genetic Approach .....                                                              | 202 |
| <i>Ulviye Hacizade</i>                                                                                                                   |     |
| Nonlinear Two-Stage Kalman Filter for in-Orbit Calibration of Magnetometers.....                                                         | 207 |
| <i>Chingiz Hajiye</i>                                                                                                                    |     |
| Mathematical Modelling for Cholera Epidemic in Iraq.....                                                                                 | 212 |
| <i>Hameed Husam Hameed, Hayder M. Al-Saedi, Mohammed H. Al-Mayyah</i>                                                                    |     |
| General Equilibrium Models of Azerbaijan Economy: Conceptual View and Multiplier Effects .....                                           | 216 |
| <i>Yadulla Hasanli, Gunay Rahimli</i>                                                                                                    |     |
| Optimal Control with Nonlinear Feedback of the Power of Sources During Heating of the Rod .....                                          | 221 |
| <i>Vugar Hashimov</i>                                                                                                                    |     |
| Investigation of a Boundary Functional of a Semi-Markov Process Using Inverse Laplace<br>Transform .....                                 | 225 |
| <i>Elshan Ibayev, Konul Omarova</i>                                                                                                      |     |
| Comparison of Two Heuristic Algorithms for Correlation Clustering Problem Solving.....                                                   | 228 |
| <i>Ellada Ibragimova, Daria Semenova, Aleksandr Soldatenko</i>                                                                           |     |
| Multidisciplinary Expert System for Etymologization of Oghuz Ethnonyms .....                                                             | 232 |
| <i>Ismayil Ismayilov</i>                                                                                                                 |     |
| University Scheduling System on the Bologna Form of Education .....                                                                      | 236 |
| <i>Rashad Ismibayli, Sona Rzayeva</i>                                                                                                    |     |
| The Role of GPT Models in Education: Challenges and Solutions.....                                                                       | 241 |
| <i>Kamran Jafarzade</i>                                                                                                                  |     |
| Generalized Derivatives and Optimality Conditions in Nonconvex Analysis and Some Calculus<br>Rules.....                                  | 244 |
| <i>Refail Kasimbeyli</i>                                                                                                                 |     |
| Determination of the Developing Indicators of Gas Layers Whose Rocks Are Creeping<br>Deformation During Operation by Inclined Wells..... | 247 |
| <i>Bunyad Kazymov, Asadulla Mammadov</i>                                                                                                 |     |
| Signal Recognition Method Based on Additive Convolution of Two Proximity Criteria.....                                                   | 250 |
| <i>Azer Kerimov</i>                                                                                                                      |     |

|                                                                                                                                              |     |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Computer System of Analysis of the Mass Exam Results .....                                                                                   | 254 |
| <i>Chingiz Khalilov, Elshan Mustafayev, Ilgar Mahmudov, Rustam Azimov</i>                                                                    |     |
| Investigation of Upper Bound for the Ruin Probability by Approximate Methods in a Nonlinear Risk Model with Gamma Claims .....               | 258 |
| <i>Tahir Khaniyev, Basak Gever, Zulfiye Hanalioglu</i>                                                                                       |     |
| Comparative Analysis of Hashing Standards .....                                                                                              | 261 |
| <i>Illia Kovalov, Galina Kozina</i>                                                                                                          |     |
| Fragmentary Models for Some Classes of Vehicle Routing Problems .....                                                                        | 264 |
| <i>Igor Kozin, Ulugbek Narzullayev, Oleksandr Cheverda</i>                                                                                   |     |
| Modeling of the COVID-19 Epidemic in the Russian Regions Based on Deep Learning .....                                                        | 267 |
| <i>Olga Krivorotko, Nikolay Zyatkov</i>                                                                                                      |     |
| About One Design Scheme for Solving the Problem of Vibration of Reinforced Viscoelastic Pipe .....                                           | 272 |
| <i>Kurbanov Nabi, Babajanova Vusala, Aliyeva Ulviya</i>                                                                                      |     |
| A Fuzzy Decision-Making Model for Investors in the Electric Vehicle Market.....                                                              | 275 |
| <i>Serhii Kurkula, Nataliia Maksyshko</i>                                                                                                    |     |
| Optimal Control of Service Rates of Discrete - Time (s,S) Queueing - Inventory Systems with Finite Buffer .....                              | 278 |
| <i>Iniya Lakkumikanthan, Sivakumar Balasubramanian</i>                                                                                       |     |
| Optimal Control of Elliptic Type Polyhedral Inclusions .....                                                                                 | 282 |
| <i>Elimhan N. Mahmudov, Dilara I. Mastaliyeva</i>                                                                                            |     |
| Contact-Boundary Problem for Boussinesq-Love Equation and Its Applications .....                                                             | 285 |
| <i>Ilgar Mamedov, Aynura Abdullayeva</i>                                                                                                     |     |
| Optimal Control Problem with Minimum Energy for the Process of Heat Transfer in Rarefied Media with Heat-Conduction Viscosity.....           | 290 |
| <i>Rashad Mamedov, Sardar Gasimov, Gasim Gasimov</i>                                                                                         |     |
| Application of Deep Learning Technologies in Serious Games .....                                                                             | 294 |
| <i>Anar Mammadli, Elviz A. Ismayilov</i>                                                                                                     |     |
| Selecting a Machine Learning Algorithm for the Prediction of Hepatocellular Carcinoma with the Determination of Key Indicators .....         | 298 |
| <i>Masuma Mammadova, Zarifa Jabrayilova, Lala Garayeva</i>                                                                                   |     |
| Decision-Making Based on Information in Medical Media Resources .....                                                                        | 302 |
| <i>Masuma Mammadova, Zarifa Jabrayilova, Nargiz Shikhaliyeva</i>                                                                             |     |
| Principles of Formation of Transliteration Rules for the Azerbaijani Language Using Expert Systems.....                                      | 305 |
| <i>Masuma Mammadova, Sabina Mammadzada</i>                                                                                                   |     |
| Necessary Optimality Conditions for Dynamic Systems Described by Ordinary Stochastic Difference Equations .....                              | 309 |
| <i>Kamil Mansimov, Rashad Mastaliyev</i>                                                                                                     |     |
| Necessary Conditions for a Minimum in the Problems of Variation with Delayed Argument in the Presence of Various Types of Degenerations..... | 312 |
| <i>Telman K. Melikov, Gulnar V. Hajieva</i>                                                                                                  |     |

|                                                                                                                                                         |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A Multi-Criteria Problem of Choosing an Alternative to SPI in a Fuzzy Environment by Applying the CODAS Method .....                                    | 315 |
| <i>Malahat Murtuzayeva, Samir Pur Riza</i>                                                                                                              |     |
| Representativeness of Sample Statistics in Solution of a Stochastic Two-Criteria Control Problem .....                                                  | 320 |
| <i>Hasan Nagiev</i>                                                                                                                                     |     |
| Determination of the Location Valuation Index Based on Public Transportation in Big Cities.....                                                         | 324 |
| <i>Resmiye Nasiboglu, Efendi Nasibov</i>                                                                                                                |     |
| Interactive Solution of Reservoir Management and Optimization .....                                                                                     | 327 |
| <i>Elnur Nuri</i>                                                                                                                                       |     |
| Heuristic Algorithm for Solving Travelling Salesman Problem: Adding the Endpoints of the Longest Edges .....                                            | 332 |
| <i>Fidan Nuriyeva</i>                                                                                                                                   |     |
| Some Hermite-Hadamard-Type Integral Inequalities for Multidimensional Log-Convex Stochastic Processes .....                                             | 336 |
| <i>Nurgül Okur, Rovshan Aliyev</i>                                                                                                                      |     |
| Determining Probability Distributions of Contributing Resources to Energy Generation in Türkiye by Maximum Entropy Method .....                         | 340 |
| <i>Ibrahim Öztas, Nurgül Okur, Hasan Hüseyin Gül</i>                                                                                                    |     |
| An Approach to Solution to Problem for Restoring Sources of Special Type in Parabolic Equation.....                                                     | 345 |
| <i>Anar Rahimov</i>                                                                                                                                     |     |
| Time Series Analysis of Biogas Monitoring with Deep Learning Approaches .....                                                                           | 349 |
| <i>Vladislav Rudakov, Merembayev Timur, Amirgaliyev Yedilkhan, Omarova Perizat</i>                                                                      |     |
| Ant Colony Based Approach for Finding Cost-Optimal Path .....                                                                                           | 353 |
| <i>Andrey Sergeevich Rychkov, Majid Elkhan Ogly Abbasov</i>                                                                                             |     |
| A Generating System for Creating a Training Set to Convert Table Images into HTML Files .....                                                           | 356 |
| <i>Mikayil Sadigzade, Resmiye Nasiboglu, Efendi Nasibov</i>                                                                                             |     |
| Attention-Based CNN-BiLSTM Deep Learning Approach for Network Intrusion Detection System in Software Defined Networks .....                             | 359 |
| <i>Rachid Ben Said, Iman Askerzade</i>                                                                                                                  |     |
| Enhancing the Street Geometry Extraction by Fusion of Thermal/Visible Images for Visual Servoing .....                                                  | 364 |
| <i>Ayham Shahoud, Dmitriy Shashev, Stanislav Shidlovskiy</i>                                                                                            |     |
| Applying Deterministic Factor Analysis to Study Gas Well Operation.....                                                                                 | 367 |
| <i>Alexander Shchekin, Victoria Verzhbitskaya, Alexander Handzel</i>                                                                                    |     |
| Comparison of Optimal Solutions of Clusters Created Using Clustering Algorithm with Meta-Heuristic Algorithms in Capacity Vehicle Routing Problem ..... | 370 |
| <i>Adem Sehitoglu, Charkaz Aghayeva</i>                                                                                                                 |     |
| An Exact Nonsmooth Penalty Approach for a Special Class of Linear Programs.....                                                                         | 373 |
| <i>Petro Stetsyuk, Andreas Fischer, Olha Khomiak</i>                                                                                                    |     |
| Sentiment Analysis of Social Media Comments Using Machine Learning Algorithms .....                                                                     | 376 |
| <i>Laman Taghiyeva, Narmin Hasanova, Masuda Omarova, Samir Rustamov</i>                                                                                 |     |



|                                                                                                                                     |     |
|-------------------------------------------------------------------------------------------------------------------------------------|-----|
| Analysis of Methods and Systems for Natural Gas Composition and Energy Characteristics<br>Determination.....                        | 381 |
| <i>Sergei Vaskovskii, Ivan Brokarev</i>                                                                                             |     |
| Exact and Approximate Solution Problem of Managing the Reserve of Capacity of Arcs a<br>Communication Network .....                 | 387 |
| <i>Volodymyr Vasyanin, Olexander Trofymchuk, Liudmyla Ushakova</i>                                                                  |     |
| On the Unique Solvability of a Nonlocal Boundary Value Problem for Fourth-Order Hyperbolic<br>Equation with Impulsive Actions ..... | 392 |
| <i>Shakir Yusubov, Minayye Huseynova</i>                                                                                            |     |
| $\varepsilon$ -Subgradient Algorithm with Space Transformation .....                                                                | 396 |
| <i>Mykola Zhurbenko</i>                                                                                                             |     |
| Identifiability Analysis for Source Problem of Quasi-Hyperbolic Equation .....                                                      | 399 |
| <i>Tatiana Zvonareva, Olga Krivorotko</i>                                                                                           |     |

## **Author Index**