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International Conference 03

Intelligent Robotics and Mechatronics Artificial Intelligence

Зияткерлік робототехника және мехатроника
Жасанды интеллект



National Engineering Academy of the Republic of Kazakhstan

Қазақстан Республикасының Ұлттық инженерлік академиясы

Gylym Ordasy, Large Hall
28 Shevchenko Street, Almaty

Ғылым ордасы, Үлкен зал
Алматы қаласы, Шевченко көшесі, 28

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Plenary Session / Пленарлық отырыс

Venue **Өтетін орны**	Gylym Ordasy, Main Conference Hall Ғылым ордасы, Үлкен зал
Moderator **Модератор**	**Marco Ceccarelli**
Secretary **Хатшы**	**Alimbayev Chingiz A.**

Time Уақыт	Event Іс-шара
08:30–09:00	**Reception of Participants and Guests** Қатысушылар мен қонақтарды қарсы алу
09:00–09:15	**Challenges in Mechanism Design for Robotics** Робототехникаға арналған механизмдерді жобалаудағы сын-қатерлер **Marco Ceccarelli / Марко Чеккарелли** Professor, University of Rome Tor Vergata, Honorary Academician, NEA RK Профессор, Римнің Тор Вергата университеті, ҚР ҰИА Құрметті академигі
09:15–09:35	**Design of the Gravitational Equilibrium Mechanisms Used for Wheelchairs Back- and Footrest** Мүгедектер арбасының арқалығы мен аяқ тіреуіне арналған гравитациялық теңгеру механизмдерін жобалау **Erwin-Christian Lovasz / Эрвин-Кристиан Ловаш** Professor, Politehnica University of Timişoara, Romania Профессор, Тимишоара политехникалық университеті, Румыния
09:35–09:55	**Design and Application of Robots with High Environmental Adaptability** Қоршаған ортаға бейімділігі жоғары роботтарды жобалау және қолдану **Song Yifeng / Сун Ифэн** Professor, Shenyang Institute of Automation, Chinese Academy of Sciences, China Профессор, Қытай ғылым академиясының Шэньян автоматтандыру институты, Қытай
09:55–10:15	**Equations of Motion of Robotic Systems with Programmed Constraints** Бағдарламалық байланыстары бар робототехникалық жүйелердің динамика теңдеулері **Mukharlyamov Robert G. / Мухарлямов Роберт Гарабшевич** DSc in Physics and Mathematics, Professor, Patrice Lumumba Peoples' Friendship University of Russia, Russia Физика-математика ғылымдарының докторы, профессор, Патрис Лумумба атындағы Ресей халықтар достығы университеті, Ресей

Time **Уақыт**	**Event** **Іс-шара**
10:15–10:35	**Design of Parallel Manipulators for Industrial and Surgical Robotics at IzTech** IzTech-тегі өнеркәсіптік және хирургиялық робототехникаға арналған параллель манипуляторларды әзірлеу **Gökhan Kiper / Гёкхан Кипер** Professor, Department of Mechanical Engineering, İzmir Institute of Technology, Türkiye Измир технологиялық институтының Машина жасау кафедрасының профессоры, Түркия
10:35–10:55	**A Generalized Drive Control Function for Mobile Robots Transporting Heavy Loads** Ауыр жүктерді тасымалдайтын мобильді роботтардың жетегін басқарудың жалпыланған функциясы **Tuleshov Amandyk K. / Тулешов Амандық Қуатұлы** Vice-President of the National Engineering Academy of the Republic of Kazakhstan; Academician of NAS RK; Scientific Director of the U.Joldasbekov Institute of Mechanics and Engineering Қазақстан Республикасының Ұлттық инженерлік академиясының вице-президенті; ҚР ҰҒА академигі; Ө.А. Жолдасбеков атындағы Механика және машинатану институтының ғылыми жетекшісі
10:55–11:15	**Closing of the Conference Plenary Session.** Конференцияның пленарлық отырысының аяқталуы.

Parallel Sessions/ Секциялық отырыстар

№	**Session** **Секция**	Moderators Моедраторлар	Venue Өтетін орны
1	Robotics, Mechatronics and Automated Systems/ Робототехника, мехатроника және автоматтандырылған жүйелер	Assylbek Zhomartov, Askar Seidakhmet	Gylym Ordasy, Small Conference Hall Ғылым ордасы, Кіші зал
2	Artificial Intelligence and Intelligent Technologies in Robotics/ Робототехникадағы жасанды интеллект және интеллектуалды технологиялар	Sayat Ibrayev, Batyrkhan Omarov	Gylym Ordasy, Round Hall Ғылым ордасы, Дөңгелек зал

Session 1 / Секция 1

Robotics, Mechatronics and Automated Systems

Робототехника, мехатроника және автоматтандырылған жүйелер

Moderators: Assylbek Zhomartov, Askar Seidakhmet

Secretary: Balzhan Talpakova

Venue: Gylym Ordasy, Small Conference Hall

Time	Presenter	Presentation Title
14:00–14:10	**Alshyn Altybayev** Research and Production Center of Mechanical Engineering, Almaty, Kazakhstan	System-Level Prerequisites for the Robotization of Mobile Processes in Agricultural Production
14:10–14:20	**Anarkul Sadieva**, U. Kokoloeva, M. Dushenova, A. AsievaI. Razzakov Kyrgyz State Technical University, Kyrgyzstan	Methodology for the Structural Synthesis of Linkage Mechanisms with a Base Link
14:20–14:30	**Askar Seidakhmet**, A. Tuleshov, Y. Tseslik, A. Zhomartov, M. Kaliyev, A. Abduraimov, A. Kamal, N. Kumarbek, S. Makhmet U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	Control System for a Cartesian Robot for Handling Bulk Materials in a TUK-118 Container
14:30–14:40	**Aydar Elkeev**, C. Alimbayev Satbayev University, Kazakhstan	Development of an EEG-Controlled Upper-Limb Prosthesis Using an 8-Channel EEG System
14:40–14:50	**Azamat Musabayev,** N. Zhetenbayev, M. Ceccarelli Almaty University of Power Engineering and Telecommunications, Kazakhstan, University of Rome Tor Vergata, Italy	Biomechanics-Based Conceptual Design of an Active Back Support Exoskeleton for Industrial Lifting Tasks
14:50–15:00	**Chuanchao Yan**, Y. Zhang, Z. Liu, X. Zhao, R. Wang China University of Petroleum (Beijing), Karamay Campus, China	Hybrid Ground-Aerial Robots for Inspection of Unstructured Energy Facilities: Morphology, Mode Transition, and Touchdown Stability
15:00–15:10	**Dinara Bolatbekova**, D. Serik, U. Beisenali, Ch. Alimbayev, K. Ozhikenov, Zh. Alimbayeva Satbayev University, Kazakhstan	Development of a Material Database and an Automated Selection Algorithm for a Surgical Robotic Manipulator

Time	Presenter	Presentation Title
15:10–15:20	**Emil Abdraimov, A**. Abidov, K. Ziyaliev, K. Dykanaliev, A. Koshbaev, V. Eremyants Kyrgyz State Technical University named after I. Razzakov, Bishkek, Kyrgyzstan; Institute of Natural Resources named after A. S. Jamanbaev, National Academy of Sciences of the Kyrgyz Republic, Osh, Kyrgyzstan; Issyk-Kul State University named after K. Tynystanov, Karakol, Kyrgyzstan; Jalal-Abad State University named after B. Osmonov, Manas, Kyrgyzstan; Institute of Mechanical Science, Automation and Geomechanics, National Academy of Sciences of the Kyrgyz Republic, Bishkek, Kyrgyzstan	Mobility of Class II Linkage Mechanisms in a Singular Configuration of Links
15:20–15:30	**Ivan Kaspirovich** RUDN University, Russia	Adaptive Baumgarte Stabilization with Numerical Parameter Optimization in the Modeling of Constrained Systems
15:30–15:40	**Larisa Rybak,** A. Voloshkin, D. Malyshev, V. Perevuznik Federal Research Center “Computer Science and Control” of the Russian Academy of Sciences, Moscow, Russia	Design Methods for Autonomous Robotic Systems Based on a Wheeled Platform and a Manipulator with a Gear–Screw Drive
15:40–15:50	**Muratulla Utenov,** Y. Temirbekov, N. Utenov, S. Zhilkibayeva Al-Farabi Kazakh National University, Kazakhstan	Modeling of an RRRRRR Robot Manipulator and Visualization of Distribution-Intensity Diagrams of Gravitational and Motion-Inertia Forces
15:50–16:00	**Robert Mukharlyamov, Zh. Kirgizbayev** Patrice Lumumba Peoples' Friendship University of Russia, Russia	On the Derivation of the Equations of Motion for a System of Variable-Mass Rigid Bodies
16:00–16:10	**Roman Omorov**, M. Burkanov Institute of Machine Science, Automation and Geomechanics, National Academy of Sciences of the Kyrgyz Republic, Kyrgyzstan	Computer Program Implementing the Topological Robustness Method for Dynamical Systems
16:10–16:20	**Rustem Kaiyrov**, Z. Baigunchekov, M. Meirambek, F. Myrzabek, B. Bagdat Karaganda Buketov University, Kazakhstan	Application of a 3-RRS Parallel Robot for Vibration Compensation of a Ground Mobile Platform

Time	Presenter	Presentation Title
16:20–16:30	**Samgar Madikhov**, N. Zhetenbayev, M. Ceccarelli Almaty University of Power Engineering and Telecommunications, Kazakhstan, University of Rome Tor Vergata, Italy	Biomechanics-Based Design of an Active Shoulder–Elbow Exoskeleton for Industrial Applications
16:30–16:40	**Ulanbek Sopuev**, T. Zholdoshov, A. Akmatov Osh State University, Kyrgyzstan	Vibration Machine with a Frequency-Pulse Modulated Control
16:40–16:50	**Yerbol Temirbekov**, M. Utenov, B. Karassayev, S. Zhilkibayeva U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	3D Modeling of the Strength and Stiffness of Mechanisms Considering the Distributed Inertia of Motion
16:50–17:00	**Zhamila Aituganova**, A. Tuleshov Al-Farabi Kazakh National University, Kazakhstan U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	Dynamics of a Transport Mobile Robot with a Modified Ackermann Steering Mechanism in Quasi-Coordinates
17:00–17:10	Discussion and Summary	

Session 2 / Секция 2

Artificial Intelligence and Intelligent Technologies in Robotics
Робототехникадағы жасанды интеллект және интеллектуалды технологиялар

Moderators: Sayat Ibrayev, Batyrkhan Omarov

Secretary: Dinara Uipalakova

Venue: Gylym Ordasy, Round Hall

Time	Presenter	Presentation Title
14:00–14:10	**Aknazar Arysbek** Satbayev University, Kazakhstan	Conceptual foundation for an AI assisted design validation framework in safety critical domains
14:10–14:20	**Alexander Kim**, V. Kruglov Al-Farabi Kazakh National University, Kazakhstan	Training Specialists in Humanoid Robotics at Chinese Universities: Issues of Educational and Methodological Support
14:20–14:30	**Ali Aristanov**, A. Ibrayev International Engineering and Technological University, Kazakhstan	Development of Software Tools for Detecting Victims in RGB Camera Images
14:30–14:40	**Aliya Amreyeva** International Engineering and Technological University, Kazakhstan	An Algorithm for Detecting Water Leaks in Sewer Networks Based on IoT and Time-Series Analysis
14:40–14:50	**Damir Khodzhayev**, A. Ibrayev International Engineering and Technological University, Kazakhstan	Multi-Agent Interaction of Autonomous Systems: Modeling Approaches in NVIDIA Omniverse
14:50–15:00	L. Rybak, **Dmitry Malyshev**, D. Dyakonov Federal Research Center “Computer Science and Control” of the Russian Academy of Sciences, Moscow, Russia	Event-Based Coordination of Task Consistency in a Group of Agents under Communication Temporary Communication Gap
15:00–15:10	**Kadyrgali Dzhamanbalin**, Z. Aldamzhar Kostanay Social and Technical University, Kazakhstan	Application of Artificial Intelligence in Manufacturing: A Case Study of the Kostanay Region
15:10–15:20	**Kamila Dosmaganbet** Turan University, Kazakhstan	Global Trends in the Development of Intelligent Service Robotics
15:20–15:30	**Kymbat Khaidarova** Satbayev University, Kazakhstan	A System for Early Detection of Difficult-to-Diagnose Heart Diseases Using Machine Learning Methods

Time	Presenter	Presentation Title
15:30–15:40	**Natalia Petrovskaya** Center for Pedagogical Excellence, HSE University, Russia	Current State and Development Prospects of Humanoid Robotics in Russia
15:40–15:50	**Nurdaulet Pirimzhanov**, N. Temirbekov, A. Temirbekov, S. Kasenov National Engineering Academy of the Republic of Kazakhstan, Kazakhstan	Development and Implementation of a Web Service for Predictive Assessment of Mineral Resources in Territories
15:50–16:00	**Olzhas Bibalayev**, S. Akhazhanov, A. Sarsembayeva, O. Bibalayev, A. Omarov Karaganda Buketov University, Kazakhstan	Artificial Intelligence-Based Monitoring of Personal Protective Equipment at Construction Sites
16:00–16:10	**Sultan Tokbayev,** A. Rakhmatulina Almaty Technological University, Kazakhstan	Preliminary Evaluation of an EEG Signal Classifier for an Upper-Limb Exoskeleton
16:10–16:20	**Yelnur Tuimebay**, C. Alimbayev, Z. Alimbayeva, K. Ozhikenov Satbayev University, Kazakhstan	Lightweight EEG Decoder for Robotic Control: Accuracy versus Complexity
16:20–16:30	**Yersultan Bakbergen**, A. Altybay International Engineering and Technological University, Kazakhstan	Explainable Self-Supervised and Noise-Robust ECG Representation Learning with Attention for Cross-Dataset Arrhythmia Classification
16:30–16:40	Discussion and Summary	

Poster Presentations

Robotics, Mechatronics and Automated Systems
Робототехника, мехатроника және автоматтандырылған жүйелер

Authors / Affiliation	Title of Contribution
Abdusamad Abdiraimov, B. Saparkulov, D. Tomilov I. Razzakov Kyrgyz State Technical University, Kyrgyzstan	Singular Configurations of a Variator with Linkage Mechanisms
Aibar Tanatov, M. Kuatova Al-Farabi Kazakh National University, Kazakhstan	Development of an Autonomous VIN-Code Marking System Using a Collaborative Robot Based on Vision-Guided Reinforcement Learning (VG-PPO)
Akniet Shaimardanov, B. Omarov, M. Russo Al-Farabi Kazakh National University, Kazakhstan	A Robot for Non-Destructive Quality Inspection of Spot Welding
Alibek Galimov, B. Omarov, M. Russo Al-Farabi Kazakh National University, Kazakhstan	A Universal Clip-On Ultrasonic Module for Robotic Non-Destructive Inspection of Resistance Spot Welds
Anar Adilkhan, A. Tuleshov, M. Kuatova, D. Kerimkulov U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	Generalized Control Function of a Differential Wheeled Mobile Robot (DWMR)
Askar Bakeev, A. Ibrayev International Engineering and Technological University, Kazakhstan	Development of Software Tools for Path Planning of Autonomous Ground Mobile Robots
Ayaulym Rakhmatulina, D. Kaiyrbekov, A. Isova U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	Research and Development of a Mobile Robotic System for Monitoring and Maintenance of Greenhouse Facilities
Balausa Beisembayeva, A. Rakhmatulina Satbayev University, Kazakhstan	Design and Structural Analysis of a Cryogenic Blast Freezing Chamber to Improve Freeze-Drying Efficiency
Bülent Özdemir, V. Shemenkov Belarusian-Russian University, Belarus	A Two-Camera Vision System for Automated Volume Measurement of Mechanical Parts
Dauren Baltabay, N. Kuandyk L. N. Gumilyov Eurasian National University, Kazakhstan	Kinematic Analysis and Motion Modeling of Robotic Manipulator for Autonomous Waste Sorting

Authors / Affiliation	Title of Contribution
Irina Goryacheva, M. Utenov, B. Karassayev, S. Zhilkibayeva Ishlinsky Institute for Problems in Mechanics, Russian Academy of Sciences, Russia	Modeling the Influence of Contacting Surface Microgeometry on Contact Stiffness and Wear of Friction Pairs
I. Tazhibay, T. Mazakov International Engineering and Technological University, Almaty, Kazakhstan	Energy-Efficient Operating Modes and Power Supply Optimization of an Unmanned Surface Vehicle
Konstantin Shalyukhin, G. Filippov Institute of Machines Science, Russian Academy of Sciences, Russia	Spherical Mechanism with a Flexible Link
Mingley Fu Zhejiang University of Technology, China	Air–Ground Collaborative Intelligent Inspection Robot System for Industrial Safety Production
Moldir Kuatova, A. Tuleshov, A. Amandyk, A. Kassimov U. Joldasbekov Institute of Mechanics and Engineering; International Engineering and Technological University, Kazakhstan	Dynamics of an Automatic Crank Press Based on a Stephenson Mechanism
Nurbibi Imanbayeva, Y. Ayazbay, O. Sadvokasov Satbayev University, Kazakhstan	Research and Development of a Gripping Device for Fruit Harvesting
Nurbibi Imanbayeva, I. Kryukov, B. Merkibayeva Satbayev University, Kazakhstan	Structural Investigation and Analysis of Kinematic Parameters of an Upper-Limb Exoskeleton Mechanism
Nurbibi Imanbayeva, D. Ospankulov, N. Sairam Satbayev University, Kazakhstan	Kinematic Investigation and Anthropometric Parameterization of a Lower-Limb Exoskeleton

Poster Presentations

Artificial Intelligence and Intelligent Technologies in Robotics

Робототехникадағы жасанды интеллект және интеллектуалды технологиялар

Authors / Affiliation	Title of Contribution
Andrey Klimov International Engineering and Technological University, Kazakhstan	Analysis of Open Heart Sound Databases and an Approach to Their Standardization for Machine Learning Applications
Argyn Rzabek International Engineering and Technological University, Kazakhstan	A Mobile Application for Personalized Emergency Alerts and Navigation
Elnar Dusekenov International Engineering and Technological University, Kazakhstan	Application of Neural Networks for Object Recognition in Industrial Robotics
Grigory Panovko, I. Lyan, A. Shokhin Mechanical Engineering Research Institute of the Russian Academy of Sciences	Intelligent Control of Vibratory Processing of Granular Materials
Anar Tynybayeva, A. Tuleshov, A. Mustafina, K. Suleimen, K. Nurymbetov, A. Kaimov Al-Farabi Kazakh National University, Almaty, Kazakhstan U. Joldasbekov Institute of Mechanics and Engineering, Almaty, Kazakhstan International IT University, Almaty, Kazakhstan	Research and Development of an IoT- and Edge AI-Enabled Robotic System for Safety Monitoring and Autonomous Patrolling
Lev Shin, T. Mazakov International Engineering and Technological University, Kazakhstan	Development of an AI Assistant with Dynamic Routing of Analytical Models Based on Automated Classification of Input Data
Radmir Karimdzhanov, A. Ibrayev International Engineering and Technological University, Kazakhstan	An Algorithm for Constructing Photogrammetric Mosaics from UAV Aerial Images Based on an Overlap Graph and Joint Homography Refinement
Symbat Khabiyeva, A. Khabiev, A. Niyetkaliyev U. Joldasbekov Institute of Mechanics and Engineering, Kazakhstan	Application of Exoskeletons and Robotic Knee Joint Systems in Early Rehabilitation After Total Knee Arthroplasty

Authors / Affiliation	Title of Contribution
Tasybek Bekenov, Z. Nusupbek, Z. Sattinova, Z. Tasybekov L. N. Gumilyov Eurasian National University, Kazakhstan	Investigation of Vehicle System Vibration Dynamics During Motion
Yerkanat Sultanov, A. Abdildayeva International Engineering and Technological University, Kazakhstan	A Software Tool for Quantitative Assessment of Ethical Risks in Artificial Intelligence Systems for Big Data Analysis
Delegatuly Zhasulan Astana IT University, Kazakhstan	Validation-Gated AI Assistance for Software Maintenance: A Repository Pilot