RoMoCo '24

13th International Workshop on Robot Motion and Control
Poznan University of Technology, 2nd- 4th July 2024, Poznań, Poland

Final Program

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Main organizer: **Institute of Automatic Control and Robotics** (IAR)
RoMoCo is technically co-sponsored by the IEEE Robotics & Automation Society
RoMoCo is financially supported by the sponsors: KUKA, EDU4INDUSTRY

Foreword

Welcome address from the General and Program Chairs

It is our pleasure to introduce you a program of the 13th International Workshop on Robot Motion and Control (RoMoCo'24), organised by the Institute of Automatic Control and Robotics at the Poznan University of Technology in Poznań, Poland.

RoMoCo has a rich history now, with its first edition held in 1999. It has become an important and well-recognised scientific event focusing on control and modelling in robotics, set in the Central-East part of the Europe. This year's event is particularly significant as it marks the 25th anniversary of the workshop series. Moreover, it is being organised after a 5-year hiatus due to the pandemic and the sudden passing of Prof. Krzysztof Roman Kozłowski (1951-2021) - a long-time proponent and orchestrator of RoMoCo workshops.

This year, out of numerous submitted papers, 46 contributed papers from 16 countries have been selected for an oral presentation. On average, each paper received three reviews, and based on the comments, all accepted papers were revised and will finally appear in the IEEE Xplore database after the event. Here, we would like to express our thanks to all the reviewers for their hard work in evaluating the papers.

Over the years, plenary talks have become a hallmark of RoMoCo, known for their high quality. This year we are grateful to the three eminent and well recognized plenary speakers: Prof. Steven M. LaValle (University of Oulu & University of Illinois), Prof. Jana Tumova (KTH Royal Institute of Technology) and Prof. Pascal Morin (Sorbonne Université, CNRS) who accepted our invitation. In addition, we have arranged a special session to commemorate Prof. Krzysztof Kozłowski and his professional achievements.

The 13th RoMoCo edition is technically co-sponsored by the IEEE Robotics and Automation Society and the Polish Chapter of the IEEE Robotics and Automation Society. A financial support was provided by the KUKA company (https://www.kuka.com/), as a Gold Sponsor, and the EDU4Industry company (https://edu4industry.com), as a Bronze Sponsor. We express our gratitude for their support. We would like to express our thanks also to the members of the International Scientific Committee and to the local arrangements staff for their help in maintaining the highest standards of the RoMoCo meeting. We hope that this year's edition of RoMoCo will be successful in terms of scientific values, allowing for discussions between young scholars and more experienced researchers. Additionally, we aim to provide social attractions that will enable you to enjoy your time in Poznań.

Welcome to RoMoCo'24 and to the Poznan University of Technology!

Dariusz Pazderski
General Chair of RoMoCo

Maciej Marcin Michałek
Program Chair of RoMoCo

Final Program at a Glance

RoMoCo '24 — IEEE Robotics & Automation Society

Day A (July 02, 2024)		Day B (July 03, 2024)		Day C (July 04, 2024)	
08:00 – 09:00	Registration desk (PUT)	08:00 – 09:00		08:00 – 09:00	
09:00 – 09:10	Welcome address	09:00 – 09:10	Announcements	09:00 – 09:10	Presentation of KUKA company
09:10 – 10:10	**Plenary lecture A:** Prof. Steven M. LaValle	09:10 – 10:10	**Plenary lecture B:** Prof. Jana Tumova	09:10 – 10:10	**Plenary lecture C:** Prof. Pascal Morin
10:10 – 10:30	Coffee break	10:10 – 10:30	Coffee break	10:10 – 10:30	Coffee break
10:30 – 10:50	Session A1: *Planning and navigation for nonholonomic systems* Papers: 20, 29, 43, 46	10:30 – 10:50	**Tribute to** Prof. K. R. Kozłowski	10:30 – 10:50	Session C9: *Control of robot manipulators* Papers No.: 8, 44, 54, 57
10:50 – 11:10		10:50 – 11:10	Session B5: *Robotic applications in agriculture* Papers: 16, 24, 38	10:50 – 11:10	
11:10 – 11:30		11:10 – 11:30		11:10 – 11:30	
11:30 – 11:50		11:30 – 11:50		11:30 – 11:50	
11:50 – 12:10	Coffee break	11:50 – 12:10	Coffee break	11:50 – 12:10	Coffee break
12:10 – 12:30	Session A2: *Mobile robot control I* Papers: 5, 11, 49, 55	12:10 – 12:30	Session B6: *Multi-robot control systems* Papers: 9, 14, 25, 52	12:10 – 12:30	Session C10: *Mobile robot control II* Papers No.: 35, 37, 39, 42
12:30 – 12:50		12:30 – 12:50		12:30 – 12:50	
12:50 – 13:10		12:50 – 13:10		12:50 – 13:10	
13:10 – 13:30		13:10 – 13:30		13:10 – 13:30	
13:30 – 14:30	Lunch (PUT)	13:30 – 14:30	Lunch (PUT)	13:30 – 14:30	Lunch (PUT)
14:30 – 14:50	Session A3: *Architectures and devices for robotic systems* Papers: 2, 30, 50, 56	14:30 – 14:50	Session B7: *Applications in rehabilitation* Papers: 3, 4, 6, 48 / Session B8: *Results with robotic potential* Papers: 28, 31, 41, 53	14:30 – 14:50	Session C11: *Machine perception* Papers: 15, 17, 51 / Session C12: *Motion planning* Papers: 10, 22, 27, 47
14:50 – 15:10		14:50 – 15:10		14:50 – 15:10	
15:10 – 15:30		15:10 – 15:30		15:10 – 15:30	
15:30 – 15:50		15:30 – 15:50		15:30 – 15:50	
15:50 – 16:10	Coffee break	15:50 – 16:10	Coffee break	15:50 – 16:10	PC-IEEE-RAS award ceremony
16:10 – 16:30	Session A4: *Applications of motion planning methods in robotics* Papers: 12, 32, 33, 34	16:10 – 16:30		16:10 – 17:30	Closing address & Farewell party (PUT)
16:30 – 16:50		16:30 – 16:50			
16:50 – 17:10		16:50 – 17:10			
17:10 – 17:30		17:10 – 17:30			
		18:30 – 20:00	City tour by tram		romoco.put.poznan.pl
20:00 – 21:30	Welcome reception	20:00 – 22:30	Banquet		

Detailed Technical Program – DAY A

09:10 – 10:10 **Room R1**	Plenary lecture A **Robot Planning and the Path to Minimalism** by Prof. Steven M. LaValle (University of Oulu & University of Illinois) Chair: Maciej Michałek
Session A1 **Room R1**	**PLANNING AND NAVIGATION FOR NONHOLONOMIC SYSTEMS** (Chair: Adam Ratajczak)
10:30 – 10:50	**The Influence of the Model Discrepancies in Jacobian Motion Planning Algorithm for Nonholonomic Systems** (A. Ratajczak, R. Orozco, J. Ratajczak)
10:50 – 11:10	**Precise and Reliable Localization of Mobile Robots in Crowds Using NDT-AMCL** (J. Weber, M. Schmidt)
11:10 – 11:30	**An Autonomous Dynamical System for Smooth Trajectory Generation in Path Tracking** (V. Pasandi, N. Andreff)
11:30 – 11:50	**Angular Frequency Switching of Holonomy-Based Motion Planning for the Second-Order Chained Form System** (M. Ito, S. Yamaguchi, M. Nakayama, M. Ishikawa)
Session A2 **Room R1**	**MOBILE ROBOT CONTROL I** (Chair: Andres Peters)
12:10 – 12:30	**Observer-Based Trajectory Tracking Control for Autonomous Mobile Robot under Discrete-Time Noisy Measurements** (J. Rubio, M. Defoort, J. Sanchez-Torres, T. Berger)
12:30 – 12:50	**Two-Layer Adaptive Funnel MRAC with Applications to the Control of Multi-Rotor UAVs** (M. Gramuglia, G. Kumar, A. L'Afflitto)
12:50 – 13:10	**Comparison of Time-Varying Stabilizing Strategies for a Kinematic Car Model: Numerical Simulations** (A. Zuyev, V. Grushkovskaya)
13:10 – 13:30	**Experimental Sensitivity Analysis of a Control Algorithm for Line Following Platooning** (F. Rifo, N. Salvador, F. Donoso, A. Peters, G. Carvajal, F. Vargas)
Session A3 **Room R1**	**ARCHITECTURES AND DEVICES FOR ROBOTIC SYSTEMS** (Chair: Cezary Zieliński)
14:30 – 14:50	**Interrupting Companion Robot Activities** (C. Zieliński)
14:50 – 15:10	**Behaviour Tree-Based Task Execution Controller for Internal Transportation Robots** (B. Cybulski, P. Smyczyński, G. Granosik)
15:10 – 15:30	**DiaBloS: Diagrams of Blocks for Systems Modeling and Simulation in Python** (M. Torres-Torriti, M. Rojas-Sepulveda)
15:30 – 15:50	**An Open-Source Rotating Device for Relative Localization in Multi-Agent Systems** (A. Joon, W. Kowalczyk)
Session A4 **Room R1**	**APPLICATIONS OF MOTION PLANNING METHODS IN ROBOTICS** (Chair: Dominik Belter)
16:10 – 16:30	**Onboard Semantic Mapping for Action Graph Estimation** (D. Herraez, M. Takahashi, Y. Kawasaki)
16:30 – 16:50	**Human-Aware Robot Trajectory Planning with Hybrid Candidate Generation: Leveraging a Pedestrian Motion Model for Diverse Trajectories** (J. Karwowski, W. Szynkiewicz)
16:50 – 17:10	**Boosting Machine Learning Techniques with Positional Encoding for Robot Collision Checking** (B. Kulecki, D. Belter)
17:10 – 17:30	**A Framework for Joint Grasp and Motion Planning in Confined Spaces** (M. Rudorfer, J. Hartvich, V. Vonasek)

09:10 – 10:10 Room R1	Plenary lecture B **Formal methods for risk-aware motion planning** by Prof. Jana Tumova (KTH Royal Institute of Technology) Chair: Wojciech Kowalczyk
10:30 – 10:50	**TRIBUTE TO Prof. K. R. KOZŁOWSKI** (Chair: Dariusz Pazderski)
Session B5 Room R1	**ROBOTIC APPLICATIONS IN AGRICULTURE** (Chair: Grzegorz Granosik)
10:50 – 11:10	**Global Path Planning for Autonomous Vehicles in Orchards and Vineyards** (T. Schönegg, T. Tuna, F. Yang, G. Waibel, M. Mattamala, M. Hutter)
11:10 – 11:30	**Adaptive Path Planning for Reaching an Uncertain Set of Targets in a Fruit Tree** (W. Kroneman, J. Valente, F. van der Stappen)
11:30 – 11:50	**Robotics in Modern Agriculture Applications Implemented by Inwebit with Scientific and Research Institutions - Robotisation of Hemp Growth and Apple Harvesting** (B. Krysiak, D. Belter, M. Bidziński, J. Codogni, K. Ćwian, B. Gawęcki, M. Gendek, M. Grabowski, M. Kraft, A. Krawczyk, B. Kulecki, T. Łukomski, M. Łysakowski, et al.)
Session B6 Room R1	**MULTI-ROBOT CONTROL SYSTEMS** (Chair: Michael Defoort)
12:10 – 12:30	**Robust, Flexible and Safe Cooperative Navigation for Multirobot Systems under Disturbances and Input Saturation** (Q.-H. Tran, Y.-C. Liu)
12:30 – 12:50	**Local Stability Analysis for Tensegrity-Based Multi-Agent Formations** (Z. Liu, M. Cao)
12:50 – 13:10	**Decentralized predefined-time leaderless consensus-formation VFO control for nonholonomic multi-agent systems** (R. Sobański, M. Defoort, M. Michałek)
13:10 – 13:30	**Reactive Cooperation of Multi-Vehicle System for Efficient Intersection Crossing Based on PIDP Speed Space Assessment** (S. He, L. Adouane)
Session B7 (p) Room R1	**APPLICATIONS IN REHABILITATION** (Chair: Teresa Zielińska)
14:30 – 14:50	**Estimating Angular Joint Positions on the Basis of Electromyographic (EMG) Activity** (X. Meng, T. Zielińska, E. Le Carpentier, Y. Aoustin)
14:50 – 15:10	**A Transformer-Based Approach to Human Posture Classification with 3D Skeleton Data** (L. Esther, E. Awong, T. Zielińska, V. Dutta)
15:10 – 15:30	**ExoReha Exoskeleton Digital Twin in Metaverse for Telerehabilitation** (P. Falkowski, F. Gwardecki)
15:30 – 15:50	**Behavior Tree Based Controller for a Soft Rehabilitation Device Stretchbox** (I. Zubrycki)
Session B8 (p) Room R2	**RESULTS WITH ROBOTIC POTENTIAL** (Chair: Eduardo Bayro-Corrochano)
14:30 – 14:50	**Analysis of ECM Battery Modeling Techniques for Different Battery Types** (M. Kamar, M. Tehrani, A. Tahir, E. Immonen, H. Haghbayan, J. Plosila)
14:50 – 15:10	**Graph Neural Networks for Recognizing Non-Verbal Social Behaviors** (A. Świetlicka, M. Kubalewski)
15:10 – 15:30	**One-Swing Stabilizer of the Inverted Pendulum on a Cart** (M. Safarini, M. Nowicki)
15:30 – 15:50	**Adaptive Control Using a Quaternion Wavelet Neural Network** (G. Martinez-Teran, E. Bayro-Corrochano)

Detailed Technical Program – DAY C

09:10 – 10:10 Room R1	Plenary lecture C **Hybrid methods for the modeling of complex nonlinear dynamics** by Prof. Pascal Morin (Sorbonne Université, CNRS) Chair: Jakub Bernat
Session C9 Room R1	**CONTROL OF ROBOT MANIPULATORS** (Chair: Yoshifumi Morita)
10:30 – 10:50	**Parallel Position and Orientation Control for a Redundant Manipulator Performing the Path Following Task** (F. Dyba)
10:50 – 11:10	**Gradient-Based Algorithm for Optimal Positioning of an Optical Instrument Used for Laser Data Transmission** (P. Bartkowiak, D. Pazderski, P. Mieszała)
11:10 – 11:30	**Usability Evaluation of Human–Robot Interaction in Manipulator Teleoperation via Virtual Reality in Inspection Tasks** (K. Kanazawa, N. Sato, Y. Morita)
11:30 – 11:50	**Hybrid OSC-RL Control for Task Optimization of Dual-Arm Robots** (M. Torres-Torriti, P. Galarce-Acevedo)
Session C10 Room R1	**MOBILE ROBOT CONTROL II** (Chair: Alexander Zuyev)
12:10 – 12:30	**End Effector Path Tracking by a 13-DOF Mobile Manipulator System Using ANN-Based Model Predictive Control** (A. Maruvattu, A. Dutta)
12:30 – 12:50	**Choreographing Safety: Planning Via Ice-Cone-Inspired Motion Sets of Feedback Controllers for Car-Like Robots** (V. Karthik, A. Verma, L. Vachhani)
12:50 – 13:10	**Predictive Follow the Gap Method for Dynamic Obstacle Avoidance** (E. Contarli, V. Sezer)
13:10 – 13:30	**Enhancing Spherical Rolling Robot Control for Slippery Terrain** (D. Spitaleri, G. Pepe, M. Laurenza, S. Milana, A. Carcaterra)
Session C11 (p) Room R1	**MACHINE PERCEPTION** (Chair: Aleksandra Świetlicka)
14:30 – 14:50	**Design of Flight Path and Environment for Creating a Standard Test Method to Evaluate Self-Localization Function of Drones in a Non-GPS Environment** (T. Kimura, N. Sato)
14:50 – 15:10	**Acoustic Odometry for Wheeled Robots on Loose Sandy Terrain** (A. Bolinches, G. Ishigami)
15:10 – 15:30	**DMODE: Differential Monocular Object Distance Estimation Module Without Class Specific Information** (P. Agand, M. Chang, M. Chen)
15:30 – 15:50	---
Session C12 (p) Room R2	**MOTION PLANNING** (Chair: Miguel Torres-Torriti)
14:30 – 14:50	**Deep Reinforcement Learning for Multi-Robot Local Path Planning in Dynamic Environments** (C.-T. Vu, Y.-C. Liu)
14:50 – 15:10	**Smooth Path Planning Using a Gaussian Process Regression Map for Mobile Robot Navigation** (Q. Serdel, J. Marzat, J. Moras)
15:10 – 15:30	**Gait Generation of 22-DOF Humanoid Robot on Hard and Deformable Terrain with Double Support Phase** (S. Gora, S. Gupta, A. Dutta)
15:30 – 15:50	**Systematic Escape Using Billiard Moves** (Y. Bahoo, S. Kundu, S. LaValle)

(p) – parallel sessions

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Welcome reception

DAY: A (July 02, 2024)

TIME: 20:00 (8:00 p.m.)

PLACE of meeting: Registration desk (PUT)

City tour by tram

DAY: B (July 03, 2024)

TIME: 18:30 (6:30 p.m.)

PLACE of meeting: Registration desk (PUT)

Banquet

DAY: B (July 03, 2024)

TIME: 20:00 (8:00 p.m.) - just after the tour by a tram

PLACE of meeting: PORT SOŁACZ Restaurant (near the tram destination station)

Farewell party

DAY: C (July 04, 2024)

TIME: 16:20 (4:20 p.m.)

PLACE of meeting: Registration desk (PUT)