



IEEE Czechoslovakia Section

20th MECHATRONIKA 2022

Programme of the
20th International Conference on Mechatronics – Mechatronika 2022

Pilsen, Czech Republic, December 7–9, 2022

20th MECHATRONIKA 2022

December 7 – 9, 2022, Pilsen, Czech Republic

Conference Programme

Wednesday, December 7th

Conference Opening (14:00)

Karel Hruška, chairman, University of West Bohemia, Czech Republic
Zdeněk Hadaš, vice-chair, Brno University of Technology, Czech Republic
Václav Křivánek, vice-chair, University of Defence, Brno, Czech Republic
Dušan Maga, vice-chair, Czech Technical University in Prague, Czech Republic

Zdenek Peroutka, dean of the Faculty of Electrical Engineering, University of West Bohemia

Session I: Power Electronics and Drives (14:20 – 15:40)

session chair: prof. **Mario Farrugia**, University of Malta, Malta

- 14:20 Martin Pittermann, Milos Straka, Vojtech Blahnik: Variants of Advanced Railway Balancer with Phase Shifting Device for 25 kV / 50 Hz Traction Substation
- 14:40 Kristóf Bándy, Péter Stumpf: Finite Set Model Predictive Control of PMSM drives with LC filter using dynamic weighting factor assignment
- 15:00 Jaroslav Dragoun, Jakub Talla: Real-time Algorithm for the Transformation of Multiple Harmonic Unbalanced Voltages into Symmetrical Components
- 15:20 Novak M.: Modeling and Experimental Validation of 18650 Battery for an Electric Bus

coffee break

Session II: Energy Harvesting (16:00 – 17:20)

session chair: prof. **Tao Dong**, University of South-Eastern Norway, Norway

- 16:00 Sosna Petr, Hadaš Zdeněk: Verification of kinetic piezoelectric energy harvesting model with periodic and chaotic responses
- 16:20 Ondrej Rubes, Martin Beno, Petr Sosna, Zdenek Hadas: Electromagnetic Trackside Vibration Energy Harvester with Cantilever Beams Spring
- 16:40 Filip Ksica, Ondrej Rubes, Jiri Kovar, Jan Chalupa, Zdenek Hadas: Smart Sensing System for Railway Monitoring
- 17:00 Hadas Z., Slaby V., Bajer J., Filkova A., Ksica F., Marcian P.: Design Concept and Test Results of Electromechanical Metamaterial Structure for Sensing and Energy Harvesting Applications

coffee break

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Session III: Automotive (17:40 – 19:00)

session chair: assoc. prof. **Tomas Komrska**, University of West Bohemia, Czech Republic

- 17:40 Keith Grima, Jake Woods, Matteo Martinelli, JeanPaul Azzopardi, Mario Farrugia: Experimental investigation of road grade and stop/start on vehicle emissions and fuel consumption
- 18:00 Martin Mach, Andre Ehram, Gervais Amani Peter Prystupa, Frank Seemann, Sebastian Bindig, Vladimír Dvořák: eWorX: All-In-One Solution for Commercial Vehicle PTOs
- 18:20 Stefan Portelli, Mario Farrugia: Mechatronics for Hydrogen Fuelling of Single Cylinder Internal Combustion Engine
- 18:40 Matteo Martinelli, Mario Farrugia: Implementing of downhill road grade on chassis dynamometer for vehicle drive cycles testing

Pilsner Urquell Visit (19:00)

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Thursday, December 8th

Session IV: Electronics (9:00 – 10:20)

session chair: dr. **Vojtech Blahnik**, University of West Bohemia, Czech Republic

- 9:00 Marek Vagaš, Jaroslav Romančík: Testing of Ethernet-based communication between control PLC and collaborative mechatronic system
- 9:20 Miroslav Tyrpekl, Martin Zavřel, Vladimír Kindl: Comparison of active and passive battery balancing
- 9:40 Martin Zavřel, Vladimír Kindl, Miroslav Tyrpekl: Analysis of Wireless Power Transmission System Behavior for Various Compensation Topologies
- 10:00 Pavel Krýsl, Martin Jára, Zdeněk Peroutka: High-frequency full-bridge LLC resonant inverter with GaN HEMT

Session V: Image Processing (9:00 – 10:20)

session chair: prof. **Zhaochu Yang**, University Chongqing, China

- 9:00 Ondřej Vaníček, Michal Chaluš, Jindřich Liška: 3D Vision Based Calibration Approach for Robotic Laser Surfacing Applications
- 9:20 Roman Knobloch, Jaroslav Mlýnek: Perfect Bit Fields and Their Technical Application
- 9:40 Jan Šnajder, Jiří Krejsa: Classification of Czech Sign Language Alphabet Diacritics via LSTM
- 10:00 Paolo Lino, Irene Mazzilli, Gianmario Mirabile, Nikolai Svishchev: UAV Adaptive Trajectory for Detection of Xylella Fastidiosa Disease in Olive Trees

coffee break

Session VI: Measurement (10:40 – 12:00)

session chair: assoc. prof. **Gabriel Gaspar**, University of Zilina, Slovak Republic

- 10:40 Lukáš Zdražil, Zdeněk Roubal: Design and characteristics of an amplifier for low currents measurements
- 11:00 Martin Doseděl, Ladislav Kopečný, Zdeněk Havránek, Matúš Kozovský, Jakub Hnidka: Detection of the Interturn Shorts of a Three-Phase Motor Using Artificial Intelligence Processing Vibration Data
- 11:20 Oliver Utz Wetter, Holger Heeren, Timo Hackbarth: Calibration and optimization of non-linear 6D force/torque cells
- 11:40 Jiří Venský, Oldřich Ševeček, Petr Skalka, Michal Kotoul, Ivo Stachiv: Mass sensing using micromechanical resonators operating in nonlinear regime

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Session VII: Industry 4.0 and Military Technologies (10:40 – 12:00)

session chair: mjr. dr. **Vaclav Krivanek**, University of Defence, Czech Republic

- 10:40 Benjamin Evans; Sebastian Braun; Jessica Ulmer; Jörg Wollert: AAS Implementations - Current Problems and Solutions
- 11:00 Vadim Starý, Lukáš Gacho: Webots open source robot simulator capabilities for modelling and simulation of ground-based air defence
- 11:20 Ladislav Kopecny, Jakub Hnidka, Josef Bajer: Preliminary design of a fixed-winged UAV autopilot for take-off phase and its assessment
- 11:40 Mohsen Ebadpour, Jakub Talla, Mohammad (Behdad) Jamshidi, Zdenek Peroutka: EKF Digital Twinning of Induction Motor Drives for the Metaverse

coffee break

Session VIII: Electric Machines (12:20 – 13:40)

session chair: assoc. prof. **Stanislav Vechet**, Brno University of Technology, Czech Republic

- 12:20 Vaclav Fiala, Pavel Dvorak, Roman Pechanek: Practical approach to multi-objective optimization in ANSYS softwares
- 12:40 Jan Laksar, Radek Cermak, Jiri Drazan: Comparison of Five-Phase Winding Configurations of High-Speed PMSM Feasible to the Third Harmonic Current Injection
- 13:00 Jan Laksar, Jiri Drazan: Finite Element Calculation of Inductances of Internal Permanent Magnet Motors
- 13:20 Martin Vins, Jaroslav Dragoun, Patrik Kalaj, Martin Sirovy: Turbomachinery Mechanical Oscillations Analysis and Active Compensation Design by EESS in Thermal Power Plant

Session IX: Mechanical Engineering (12:20 – 13:40)

session chair: assoc. prof. **Zdenek Hadas**, Brno University of Technology, Czech Republic

- 12:20 Michał Krygier, Paweł Żak, Leszek Podseǳkowski, Piotr Wróblewski, Maciej Podseǳkowski: A novel autonomous balancing system for shafts in motion
- 12:40 Barnabás Dobossy, Roman Adámek, Filip Radil, Martin Brabc: Time-frequency Analysis of Accelerometry Data for Detection and Identification of Faults on Pneumatic Production Machine
- 13:00 Libor Sova, Milada Krejčová: An importance of reduced order modelling for building a digital twin
- 13:20 Jan Jakl, Jindřich Liška, Josef Kuta: On-line compensation of axial fan blade angle in blade tip timing measurement

conference lunch

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Session X: Robotics and Mechanical Engineering (14:40 – 16:00)

session chair: assoc. prof. **Juraj Dudak**, Slovak University of Technology in Bratislava, SK

- 14:40 Karel Kalista: Rotordynamic force measurement using piezoelectric sensors mounted under magnetic bearings
- 15:00 Jindrich Liska, Jan Jakl, Sven Kunkel, Eduard Janecek: Real-time turbine-generator rotor torsional vibration monitoring
- 15:20 Darina Hroncová, Ľubica Miková, Erik Prada, Róbert Rákay, Peter Ján Sinčák, Tomáš Merva: Forward and inverse robot model kinematics and trajectory planning
- 15:40 Siarhei Autso, Toomas Vaimann, Anton Rassõlkin, Karolina Kudelina, Bilal Asad: Influence of Different Tooth Belt Transmission Faults on the Work of a Cartesian Robot

coffee break

Session XI: Poster Session (16:20 – 18:00)

session chair: assoc. prof. **Karel Hruska**, University of West Bohemia, Czech Republic

- 16:20 For poster list please see page 9.

Conference Dinner (19:00)

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Friday, December 9th

Session XII: Biomechanics and Robotics (9:00 – 10:20)

session chair: prof. **Kuo-Shen Chen**, National Cheng Kung University, Taiwan

- 9:00 Lýdie Leová, Slavka Čubanová, Jan Hejda, Petr Volf, Patrik Kutílek, Jan Hýbl, Aleksei Karavaev, Marek Sokol: IMU and software for recording and evaluating the movement of the firearm and shooter during shooting
- 9:20 Mohammad (Behdad) Jamshidi, Mohsen Ebadpour, Mona Malekzadeh Moghani: Cancer Digital Twins in Metaverse
- 9:40 Michal Chaluš, Ondřej Vaníček, Jindřich Liška: Modified Object Detection for Hand-Eye Calibration of Laser Profile Scanner
- 10:00 Krejsa Jiri, Vechet Stanislav, Chen Kuo-Shen: Mobile Robot in the Elevator: What Floor Am I On?

coffee break

Session XIII: General Mechatronics (10:40 – 12:00)

session chair: prof. **Dusan Maga**, Czech Technical University in Prague, Czech Republic

- 10:40 Soumya K Manna: Accuracy and Repeatability Study of An Elbow Exoskeleton for Multistage Exercises
- 11:00 Josef Časar, Miroslav Krátký: Modelling and simulation of Ground Based Air Defence War Games

Closing Speech (12:00)

conference lunch

Conference Programme

Posters

Si-Chen Pan, Kuo-Shen Chen, Stanislav Vechet: Design and Control of an Active Stage for Suppressing Motion Induced Vibration in Optical Inspection Systems

Juraj Ďuďák, Gabriel Gašpar, Roman Budjač, Ivan Sládek: Design of a driver for measurements with piezoelectric elements

Roman Adámek, Marvin K. Bugeja, Simon G. Fabri, Robert Grepl: Enhancing the Obstacle Avoidance Capabilities of a Smart Wheelchair

Alişan Sari, Mahmut Emin Çelik: Improving Hardware Quality Measurements Using Automated Testing

Ngoc Nam Pham, Jan Leuchter, Quang Huy Dong: FPGA-based measurement instrument for the ERT applications of aerospace composite materials

Martin Lučan, František Duchoň, Martin Baťa, Dávid Mikle, Kristian Andocs: Design of Emergency Brake System for Autonomous Electric Racing Vehicle

Zhijie Li, Guangcan Yang, Zhou Peng, Xiaoxin Liu, Xiaoyan Hu, Huangyu, Jinbao Liu, Wen Liu, Zhongyuan Shi, Yongqing He, Zhaochu Yang, Tao Dong: Experimental investigation on evaporation of single droplet levitated in acoustic field

Paweł Dymora, Mirosław Mazurek: A comparative analysis of selected tools for data analysis and mining

Vladimir Kindl, Martin Zavrel, Miroslav Tyrpekl, Jiri Sika: Analysis of coupling elements for wireless power transfer with primary side compensation

Stanislav Vechet, Jiri Krejsa, Kuo-Shen Chen: Autonomous vehicles lane detection using particle filters

Jakub Brazina, Vojtech Stepanek, Michal Holub, Jan Vetiska, Frantisek Bradac: Application of Industry 4.0 trends in the teaching process

Michal Holub, Ondrej Andrs, Vojtech Stepanek, Jiri Kroupa, Rostislav Huzlik, Jiri Tuma, Jiri Kovar, Tomas Marada, Frantisek Bradac: Experimental study of operational data collection from CNC machine tools for advanced analysis

Martin Formánek, Martin Appel, Jiří Jagoš, Jiří Kohút, Matej Rajchl: Dynamic model of peristaltic pump with arterial tree for real-time pressure waveform control

Lukas Sobotka, Roman Pechanek, Martin Skalicky, Lukas Veg: Thermal and Ventilation Analysis of PMSG with a Radial External Fan

Tomas Paveza, Jiri Drazan, Radek Cermak: Design of a Double Rotor BLDC Motor with Halbach Array Magnets

Radek Cermak, Jiri Drazan, Jan Laksar, Karel Hruska: Multiphase winding analysis methodology

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Damian Gaška, Jerzy Margielewicz, Grzegorz Litak, Piotr Wolszczak, Sławomir Bucki: Impulse Excitation Diagram as a tool to achieve high energy orbits

Tomáš Košan, Jiří Cibulka, Libor Poláček, Pavel Turjanica: Control Unit for Energy Harvesting for Freight Wagon

Zdenek Kehl, Tomas Glasberger, Zdenek Peroutka: Predictive control of a multilevel active filter and compensator

Guozhen He, Tao Dong, Zhaochu Yang, Ningling Zhou, Wenyu Mou: Probe sonication to prepare homogenous WO₃ nanosheet inks for energy conversion and biosensing applications

Sławomir Kowalski, Iga Pietrucha, Kamil Baziak: The use of mechatronic systems in garden irrigation

Lukas Veg, Lukas Sobotka, Martin Skalicky, Zdenek Frank: Development of an Impingement Jet Cooling System Usable for Small Traction Electric Motor

Kusuma Priya Krovi: Comparison of Efficiency for Synchronous Buck Converter Using Si and WBG materials

Othman, A., Maga, D., Hrad, J.: Multi-input Energy Harvesting System with Battery Management System for WSN Applications

Luboš Streit, Tomáš Košan, Jiří Hammerbauer: CAN controlled 120 cells Li-Ion battery with integrated BMS and protection

Jan Otýpka, Roman Pechánek, Zdeněk Frank: The Tool for Losses Analysis of Induction Motor Fed by Converter PWM

Hruska, K., Laksar, J., Dvorak, P.: Electric Machines Inductances and their Non-Linear Behaviour

Gabriel Gaspar, Juraj Dudak, Roman Budjac, Stefan Sedivy, Martin Skovajsa, Simona Gasparova: Prototyping of wearable electronics components at the Research Centre of University of Zilina

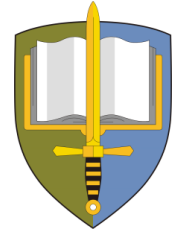
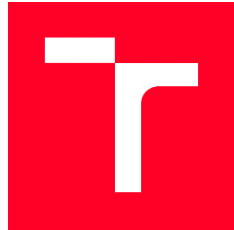
Ondrej Suchy, Stepan Janous, Jakub Talla, Zdenek Peroutka: Predictive control of IPMSM using feedback from the torque sensor to compensate for model uncertainties

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Wednesday, 7. 12. 2022			Thursday, 8. 12. 2022			Friday 9. 12. 2022				
from	Secese	Closet	from	Secese	Closet	from	Secese	Closet		
			9:00	Session IV	Session V	9:00	Session XII			
			9:20						9:20	
			9:40						9:40	
			10:00						10:00	
			10:20	CB		10:20	CB			
			10:40	Session VI	Session VII	10:40	Session XIII			
			11:00						11:00	
			11:20						11:20	
			11:40						11:40	
			12:00	CB		12:00	Closing			
12:00	Registration		12:20	Session VIII	Session IX	12:20	LUNCH			
12:20			12:40						12:40	
12:40			13:00						13:00	
13:00			13:20						13:20	
13:20			13:40	LUNCH		13:40				
13:40		14:00	LUNCH		14:00					
14:00	Session I		14:20	Session X						
14:20			14:40							
15:00			15:00							
15:20	CB		15:20	Session XI: Poster Session						
15:40			15:40							
16:00	Session II		16:00							
16:20			16:20							
16:40			16:40							
17:00	CB		17:00							
17:20			17:20							
17:40	Session III		17:40							
18:00			18:00							
18:20			18:20							
18:40			18:40							
19:00			19:00	Conference dinner						



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