CONFERENCE ABSTRACT

Prague, Czech Republic / October 11-13, 2019

ICACR 2019
2019 3rd International Conference on Automation, Control and Robots

ICMES 2019
2019 4th International Conference on Mechatronics and Electrical Systems

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Table of Contents

Guide for Participants

Instruction of Presentations

Note: The following time arrangement is for reference only. In case that any absence or some presentations are less than 15 minutes, please come at least 30 minutes before your presentation.
*An excellent presentation will be selected from each session which will be announced and awarded the certificate.

Safety Precautions

- For the safety of your properties, participants are required to wear attendee card in the conference period. Please don't carry other conference unrelated people to enter the conference room. The onsite staff or Committee members has the right to stop those without the name card from entering the meeting room.
- Please take care of your value belongs of your own. Please note that the Organizing Committee and the onsite staff will not accept liability for any kind of damage, losses or injuries occurring to persons or personal belongings during the conference.

Devices Provided by the Conference Organizer

- Laptops (with MS-Office & Adobe Reader)
- Projectors & Screen
- Laser Pointers

Materials Provided by the Presenters

- Oral presentation: PowerPoint or PDF files (USB flash disk)

Note: Please copy your slide file to the desktop before the session starts. During your poster session, the author should stay by your poster paper to explain and discuss your paper with the visitors.

Duration of Each Presentation

- Regular Oral Session: About 15 Minutes of Presentation including Q&A.

About Dress Code

- All participants are required to dress formally. Casual wear is unacceptable.
- National formal dress is acceptable

Welcome Letter

We are pleased to welcome you to 2019 3rd International Conference on Automation, Control and Robots (ICACR 2019) and 2019 4th International Conference on Mechatronics and Electrical System (ICMES 2019) which will be held in Prague, Czech Republic on October 11-13, 2019.

We wish to express our sincere appreciation to all the individuals who would contribute to ICACR 2019 & ICMES 2019 in all kinds of ways. Special thanks to all the authors as well as the Conference Committee members and reviewers. Their high competence, their enthusiasm, their time and expertise knowledge, enabled us to prepare the high-quality final program and helped to make the conference a successful event.

Once again, thanks for supports to this conference, we are delegate to higher and better international conference experiences. We will sincerely listen to any suggestion and comment; we are looking forward to meeting you next time.

Prague is one of the most beautiful, vibrant and cultural places. It is blessed with a number of interesting places that are culturally endowed and these can be explored at length on foot. We hope your stay in Prague, Czech Republic will be memorable!

ICACR 2019 & ICMES 2019 organizing committees

Prague, Czech Republic

Conference Agenda

< October 11, 2019, Friday>

Lobby	
10:00-16:00	Registration & Materials Collection

Morning < October 12, 2019, Saturday>

Cracow I+II (2nd Floor)	
Conference Host	
09:30-09:35	**Opening Remarks** **Assoc. Prof. Jan Faigl** *Czech Technical University (CTU), Czech*
Speech I 09:35-10:20	**Prof. Chun-Yi Su** *Concordia University, Canada* **Title: Modeling and Control of Dielectric Elastomer Actuators in Soft Robots**
10:20-10:45	**Coffee Break**
Speech II 10:45-11:25	**Assoc. Prof. Jan Faigl** *Czech Technical University (CTU), Czech* **Title: Terrain Learning with Multi-legged Walking Robots in Autonomous Exploration Missions**
Speech III 11:25-11:55	**Assoc. Prof. Ahmed Abdelgawad** *Central Michigan University, USA* **Title: Signal Processing Art for Internet of Things (IoT)**
11:55-12:00	**Group Photo**

12:00-14:00	**Lunch Time**  **Location: Loreta Restaurant (2nd Floor)** Note: Lunch coupon is needed for entering the restaurant. Please enter the restaurant on time.

Afternoon < October 12, 2019, Saturday >

14:00-16:00	**Session I** Robot Design and Intelligent Control	 Cracow I (2nd Floor)
ES111: A New Impedance Control Method Using Backstepping Approach for Flexible Joint Robot Manipulators ES113: Rotational Invariant Object Recognition for Robotic Vision ES114: A Modular Simulation Platform for Training Robots via Deep Reinforcement Learning and Multibody Dynamics ES115: Multiobjective Problem to Find Paths Through Swarm Robotics ES123: Sampling Based Motion Planning via Control Barrier Functions ES124: Control Algorithms for a Mobile Robot Application in a Fog Computing Environment ES015: A Novel System of Primary Oscillations for Micromechanical Gyroscope ES105: Automatic UAV Wireless Charging over Solar Vehicle to Enable Frequent Flight Missions		
14:00-16:15	**Session II** Mechatronics and Industrial Automation	 Cracow II (2nd Floor)
ES110: A Novel Varying Angle Fiber-Reinforced Elastomer as a Soft Pneumatic Bending Actuator ES118: Designing PSO-Based PI-type Fuzzy Logic Controllers: A Typical Application to Load-Frequency Control Strategy of an Interconnected Hydropower System ES008: Portable Rotary-angle Detector for Industrial Motor Inspection ES012: Tests of Electrical Motor for Installation in the Wheel Hub of an Electric Car ES106: Distributed Manufacturing: A Vision about Shareconomy in the Manufacturing Industry ES107: Shape Optimization Technique in 3D printing ES102: A Modeling and Simulation Approach for the Design of Linear Feeding Systems in Industrial Automation		

ES104: Method of Industrial Automated Optical-Electronic Control of Granulometric Composition of Mineral Fertilizers ES013: Study of Filler Effect on Dielectric Strength of Epoxy Insulator Using Artificial Neural Network

16:15-16:30	**Coffee Break**

16:30-18:45	**Session III** Signal Processing and Control System	 Cracow I (2nd Floor)
ES101: Connected Vehicle: Monitor Automotive Embedded Systems via IoT Protocol UI ES109: Detection and Parameters Estimation of Moving Objects via Video Surveillance ES117: Obtaining the Data for Formation of 3D Road Scene from the Radar Data ES121: Simultaneous State and False-Data Injection Attacks Reconstruction for NonLinear Systems: an LPV Approach ES125: Distributed Manufacturing: A Vision about Shareconomy in the Manufacturing Industry ES011: Fault Diagnosis of Ball Bearing Using Hilbert Huang Transform and LASSO Feature Ranking Technique ES016: On-the-fly Fingerprint Acquisition Method ES122: On the Event-based Attack-tolerant Control: A Polytopic Representation ES119: Serious Game based on Skeleton Shape Matching for Functional Rehabilitation Exercises		
19:00-20:30	**Dinner Time**  **Location: Bull & Bonito Restaurant (Ground floor)** Note: Dinner coupon is needed for entering the restaurant. Please enter the restaurant on time.	

< October 13, 2019, Sunday>

One Day Tour in Prague
To make better use of your precious time on October 13, 2019, you are free to arrange your own discovery tourism in Prague.

Conference Venue

Vienna House Diplomat Prague

Address: Evropska 15, 16041 Prague, Czech Republic

Getting There:

By Train:

- From the main railway station:
  The easiest way is to take the nr. 26 tram towards Divoká Šárka and alight at Dejvická.
  (Journey time: approx. 20 mins. Fare: approx. EUR 1*)

By Air:

- From Prague Václav Havel Airport:
  Take the nr. 119 bus (the bus stop is located directly in front of Terminals 1 and 2) to Nádraží Veleslavín. Change here and take the Line A underground train in the direction of Depo Hostivař. Alight at Dejvická.
  (Journey time: approx. 30 mins. Fare: approx. EUR 1*)

By Car:

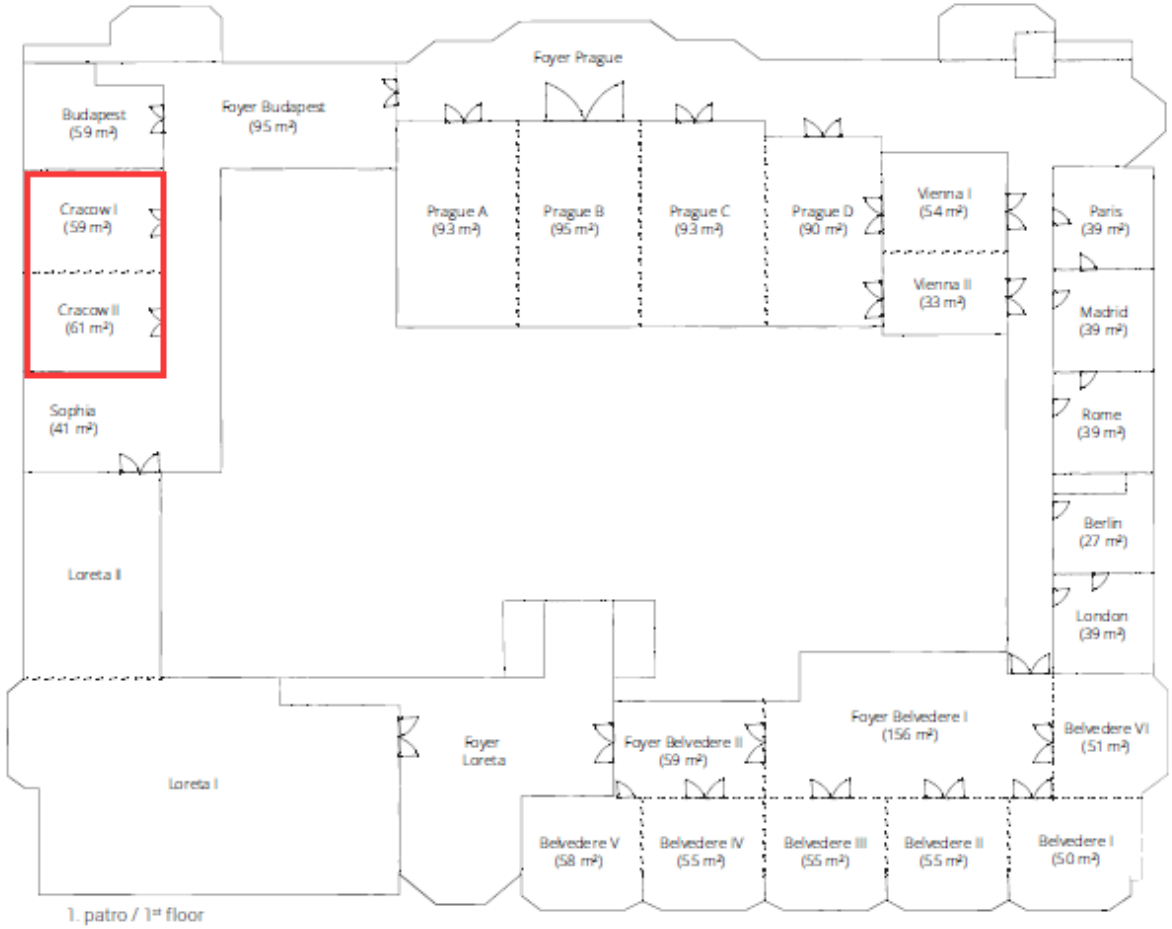
- From Vaclav Havel Airport Prague:
  Leave the airport on Aviatická and after 1 km take a slight right onto Lipská. Drive for 2 km and then take the exit toward “Praha-centrum/Ruzyně”. Turn right onto K Letišti. Continue on Evropská for 6.5 km. The Diplomat Hotel will be on the right.

Distances

- Nearest underground station Dejvicka: 100 m
- Prague Castle: 1.6 km
- City centre: 4 km

- National Theatre: 3.6 km
- Main railway station: 4.5 km
- Congress centre: 6.3 km
- Václav Havel Airport Prague: 11 km

Floor Plan:



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Conference Speakers

Prof. Chun-Yi Su,

Concordia University, Canada

Speech Title: Modeling and Control of Dielectric Elastomer Actuators in Soft Robots

Abstract:

Over the last decade, soft robots have received tremendous interests for their potential applications. Soft robots mostly refer to robotic systems with soft or compliant structures and muscle-like actuation using soft or highly deformable materials. Unlike conventional robots, they can show high deformation under actuation and change their shapes continuously along their body length, similar to octopus arms, earthworms, and elephant trunks. The key challenge for creating soft robots that achieve their full potential is the development of controllable soft bodies using materials that integrate sensors, actuators, and computation, that together enable the body to deliver the desired behavior. Among soft actuation materials, dielectric elastomers (DEs) represent an emerging/innovative class of soft actuation materials which exhibit relatively large deformations when solicited by an electric field. On the other hand, DEs are viscoelastic materials meaning that their stiffness changes with strain rate and frequency. Viscoelasticity complicates the modeling and control of the material response which is often characterized by creep, hysteresis, and stress relaxation phenomena. Owing to these intrinsic nonlinear and time variant characteristics, the precise control of DEs to determine the amount of voltage needed to obtain the deformation for soft robots becomes a non-trivial problem. In this talk, two relevant research topics are introduced in detail: modeling and control. First, the crucial techniques are presented for the model development. Next, nonlinear control based the developed model will be discussed. Finally, the future trends of the related research fields are given.

Biography:

Dr. Chun-Yi Su received his Ph.D. degrees in control engineering from South China University of Technology in 1990. After a seven-year stint at the University of Victoria, he joined the Concordia University in 1998, where he is currently a Professor of Mechanical and Industrial Engineering and holds the Concordia Research Chair in Control. His research covers control theory and its applications to various mechanical systems, with a focus on control of systems involving hysteresis nonlinearities. He is the author or co-author of over 400 publications, which have appeared in journals, as book chapters and in conference proceedings. In addition to his academic activities, he has worked extensively with industrial organizations on various projects. Dr. Su has been an Associate Editor of IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, Mechatronics, Control Engineering Practice, and several other journals. He has served as Chair/Co-Chair for numerous international conferences.

Assoc. Prof. Jan Faigl,

Czech Technical University (CTU), Czech

Speech Title: Terrain Learning with Multi-legged Walking Robots in Autonomous Exploration Missions

Abstract:

Robotic learning can be described as the robot ability to acquire and utilize the experience of the robot collected during its mission. In a particular scenario of autonomous exploration of a priori unknown environment, a multi-legged walking robot can take advantage of its locomotion capabilities to crawl various rough terrains. However, some of the terrains can be more costly to traverse than others, and therefore, a terrain characterization build online during the mission can support the overall mission performance. Besides, not only terrain learning is supportive in the exploration missions, but also adaptive locomotion control, localization, and terrain mapping have to be addressed to perform the exploration fully autonomously. In the talk, I will present examples of the developed solutions for all such essential building blocks of the autonomous exploration with a small hexapod walking robot. Finally, the talk will also cover an overview of the results achieved by the CTU-CRAS team in the Tunnel Circuit event of the DARPA Subterranean Challenge (SubT).

Biography:

Assoc. Prof. Jan Faigl received Ing. degree in Electrical Engineering, branch Technical Cybernetics, Faculty of Electrical Engineering (FEE), Czech Technical University (CTU), Czechia in 2003 and a Ph.D. degree in Electrical Engineering and Information Technology, branch Artificial Intelligence and Biocybernetics, FEE, CTU, Czechia in 2010. He was a member of the winning team for the Mohamed Bin Zayed International Robotics Challenge (MBZIRC) in Challenge 3 and the 2nd place in Challenge 1. In 2019, he participated in Tunnel Circuit event of the DARPA SubT Challenge as member of the CTU-CRAS team that took the 1st place in DARPA non-funded teams and the 3rd place among all the teams. He has served as Program Committee member in several conferences, chairs of workshops and served as the guest editor of the special issue on "Online decision making in Multi-Robot Coordination" in Autonomous Robots journal. He currently serves as the associate editor of the IEEE Transactions on Automation Science and Engineering (T-ASE). Since 2013, he is leading the Computational Robotics Laboratory (http://comrob.fel.cvut.cz) within the Artificial Intelligence Center (http://aic.fel.cvut.cz). He is also co-founder of the Center for Robotics and Autonomous Systems (http://robotics.fel.cvut.cz). Dr. Faigl had been awarded the Antonin Svoboda Award from the Czech Society for Cybernetics and Informatics in 2011. He received best poster awards for IJCNN 2017, WSOM'16, and WSOM'14, best student paper award WSOM'19, and be the finalist of the best paper awards at RSS'18 and IROS'16. His current research interests include multi-goal planning, robotic information gathering, and robotic systems for autonomous long-term missions with life-long learning, which also comprises unsupervised learning, self-organizing systems, autonomous navigation, aerial systems, and path and motion planning techniques, robotic learning and locomotion control of multi-legged walking robots.

Assoc. Prof. Ahmed Abdelgawad,

Central Michigan University, USA

Speech Title: Signal Processing Art for Internet of Things (IoT)

Abstract:

Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity. It enables the objects to collect, share, and analyze data. The IoT has become an integral part of our daily lives through applications such as public safety, intelligent tracking in transportation, industrial wireless automation, personal health monitoring, and health care for the aged community. IoT is one of the latest technologies that will change our lifestyle in the coming years. Experts estimate that as of now, there are 23 billion connected devices, and by 2020 it would reach 30 billion devices. This talk aims to introduce the design and implementation of IoT signal processing systems. The foundations of IoT will be discussed throughout real applications. Challenges and constraints for future research in IoT will be discussed. In addition, research opportunities and collaboration will be offered for the attendees.

Biography:

Dr. Ahmed Abdelgawad received his M.S. and a Ph.D. degree in Computer Engineering from University of Louisiana at Lafayette in 2007 and 2011 and subsequently joined IBM as a Design Aids & Automation Engineering Professional at Semiconductor Research and Development Center. In Fall 2012 he joined Central Michigan University as a Computer Engineering Assistant Professor. In Fall 2017, Dr. Abdelgawad was early promoted as a Computer Engineering Associate Professor. He is a senior member of IEEE. His area of expertise is distributed computing for Wireless Sensor Network (WSN), Internet of Things (IoT), Structural Health Monitoring (SHM), data fusion techniques for WSN, low power embedded system, video processing, digital signal processing, Robotics, RFID, Localization, VLSI, and FPGA design. He has published two books and more than 80 articles in related journals and conferences. Dr. Abdelgawad served as a reviewer for several conferences and journals, including IEEE WF-IoT, IEEE ISCAS, IEEE SAS, IEEE IoT Journal, IEEE Communications Magazine, Springer, Elsevier, IEEE Transactions on VLSI, and IEEE Transactions on I&M. He severed in the technical committees of IEEE ISCAS 2007/8 and IEEE ICIP 2009 conferences. He served in the administration committee of IEEE SiPS 2011. He also served in the organizing committee of ICECS2013 and 2015. Dr. Abdelgawad was the publicity chair in North America of the IEEE WF-IoT 2016/18/19 conferences. He was the finance chair of the IEEE ICASSP 2017. He is the TPC Co-Chair of I3C'17, the TPC Co-Chair of GIoTS 2017, and the technical program chair of IEEE MWSCAS 2018. He is the technical program chair of IEEE WF-IoT 2020. He delivered many tutorials in international conferences including IEEE SOCC, IEEE MWSCAS, IEEE SiPS, and APCCAS. In addition, he taught many short IoT courses in different countries. He was the keynote speaker for many international conferences and conducted many webinars. He is currently the IEEE Northeast Michigan section chair and IEEE SPS Internet of Things (IoT) SIG Member. In addition, Dr. Abdelgawad served as a PI and Co-PI for several funded grants from NSF.

Author Presentations

Technical Session 1

Topic: Robot Design and Intelligent Control

Time: 14:00pm - 16:00pm (October 12, 2019)

Venue: Cracow I-2nd Floor

Session Chair: Prof. Zhao-Hui Jiang, Hiroshima Institute of Technology, Japan

Note:

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ES111

14:00-14:15

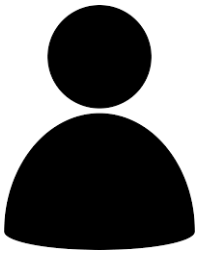
Title: A New Impedance Control Method Using Backstepping Approach for Flexible Joint Robot Manipulators

Zhao-Hui Jiang and Tetsuya Irie

Hiroshima Institute of Technology, Japan

Abstract: In this paper, we propose a new impedance control method for flexible joint robot manipulators. An ideal nonlinear impedance dynamic model is formulated in the workspace. Three control strategies that meet the requirement of desired impedance dynamics and stability of the whole system are derived by using backstepping control approach. The control system has a cascade structure with the designed three control strategies serially connecting

to each other. Stability of the closed-loop system is analyzed using Lyapunov stability theory. Impedance control experiments are carried out on a 2-link flexible joint robot manipulator with a force sensor equipped at the end-effector. The results demonstrate the effectiveness of the proposed impedance control method.



ES113

14:15-14:30

Title: Rotational Invariant Object Recognition for Robotic Vision

Cristian Vilar, Benny Thörnberg and Silvia Krug

Mid Sweden University, Sweden

Abstract: Depth cameras have enhanced the environment perception for robotic applications significantly. They allow to measure true distances and thus enable a 3D measurement of the robot surroundings. In order to enable robust robot vision, the objects recognition has to handle rotated data because object can be viewed from different dynamic perspectives when the robot is moving. Therefore, the 3D descriptors used of object recognition for robotic applications have to be rotation invariant and implementable on the embedded system, with limited memory and computing resources. With the popularization of the depth cameras, the Histogram of Gradients (HOG) descriptor has been extended to recognize also 3D volumetric objects (3DVHOG). Unfortunately, both version are not rotation invariant. There are different methods to achieve rotation invariance for 3DVHOG, but they increase significantly the computational cost of the overall data processing. Hence, they are unfeasible to be implemented in a low cost processor for real-time operation. In this paper, we propose an object pose normalization method to achieve 3DVHOG rotation invariance while reducing the number of processing operations as much as possible. Our method is based on Principal Component Analysis (PCA) normalization. We tested our method using the Princeton Modelnet10 dataset.

ES114

14:30-14:45

Title: A Modular Simulation Platform for Training Robots via Deep Reinforcement Learning and Multibody Dynamics

Simone Benatti, Alessandro Tasora, Dario Fusai and Dario Mangoni

Università di Parma, Italy

Abstract: In this work we focus on the role of Multibody Simulation in creating Reinforcement Learning virtual environments for robotic manipulation, showing a versatile, e cient and open source toolchain to create directly from CAD models. Using the Chrono::Solidworks plugin we are able to create robotic environments in the 3D CAD software

Solidworks®and later convert them into PyChrono models (PyChrono is an open source Python module for multibody simulation). In addition, we demonstrate how collision detection can be made more e cient by introducing a limited number of contact primitives instead of performing collision detection and evaluation on complex 3D meshes, still reaching a policy able to avoid unwanted collisions. We tested this approach on a 6DOF robot Comau Racer3: the robot, together with a 2 ngers gripper (Hand-E by Robotiq) was modelled using Solidworks®, imported as a PyChrono model and then a NN was trained in simulation to control its motor torques to reach a target position. To demonstrate the versatility of this toolchain we also repeated the same procedure to model and then train the ABB IRB 120 robotic arm.

ES115

14:45-15:00

Title: Multiobjective Problem to Find Paths Through Swarm Robotics

Rebeca Solis-Ortega and **Cindy Calderón-Arce**

Costa Rica Institute of Technology, Costa Rica

Abstract: In this paper, we present a scheme to solve the problem to explore, cover and define paths in dangerous environments. The proposal is organized in three phases: exploration, mapping and path planning. Swarm robotics is used in the first phase along with a stigmergy approach for the communication between the agents. The explored cell will be stored in order to create a grid map. In the path planning phase, a multiobjective problem is used to minimize distance and danger, through a graph obtained by an adapted RRG, and a genetic algorithm called modified NSGA-II.

ES123

15:00-15:15

Title: Sampling Based Motion Planning via Control Barrier Functions

Guang Yang, Bee Vang, Zachary Serlin, Calin Belta, Roberto Tron

Boston University, USA

Abstract: In this paper, we present a scheme to solve the problem to explore, cover and define paths in dangerous environments. The proposal is organized in three phases: exploration, mapping and path planning. Swarm robotics is used in the first phase along with a stigmergy approach for the communication between the agents. The explored cell will be stored in order to create a grid map. In the path planning phase, a multiobjective problem is used to minimize

distance and danger, through a graph obtained by an adapted RRG, and a genetic algorithm called modified NSGA-II.

ES124

15:15-15:30

Title: Control Algorithms for a Mobile Robot Application in a Fog Computing Environment

Bhalekar Vaibhav Bhausaheb and PS Saikrishna

Indian Institute of Technology Tirupati, India

Abstract: The growing demand of industrial, automotive and service robots presents a challenge to the centralized Cloud Robotics model in terms of privacy, security, latency, bandwidth, and reliability. Especially, mobile robots have limited on-board computational power which restricts their mission planning in autonomous applications. With the evolution of Fog computing, computations may be offloaded to Fog devices and/or smart gateway devices which together form a distributed computing platform in close proximity to the mobile robot.
In this work, we demonstrate the application of Fog computing for mobile robots with a specific case study of color based object detection, tracking and mapping in a confined area. The computations required for image processing are offloaded to the Fog devices via Fog nodes and the results are acquired back in real-time. The control algorithms for tracking predefined paths and mapping a pre- defined area are validated using a controlled mobile robot with an on-board camera and processing unit. Also, the effects of improvement in latency due to fog environment as compared to on-board computation on the mobile robot is demonstrated.

ES015

15:30-15:45

Title: A Novel System of Primary Oscillations for Micromechanical Gyroscope

Pavel Baranov, **Tamara Nesterenko,** Bien Buy Duc and Lo Van Hao

Tomsk Polytechnic University, Russia

Abstract: The paper proposes a novel system of primary oscillations produced by the microelectromechanical (MEMS) gyroscope. This system is based on a synchronous detection of the current passing through the power capacitances of MEMS gyroscope. This detection method enables the excitation and stabilization of primary oscillations during two measuring cycles. The proposed system of primary oscillations also enhances the operation speed and the accuracy of frequency control, and reduces the ambient temperature effect on the stability

of the scaling factor of the MEMS gyroscope.

ES105

15:45-16:00

Title: Automatic UAV Wireless Charging over Solar Vehicle to Enable Frequent Flight Missions

Mohammad Radi Hayajneh and Abdul Rahman Badawi

Hashemite University, Jordan

Abstract: This paper describes a design of low-cost and practical approach for recharging an unmanned aerial vehicle (UAV) autonomously for missions in remote areas. A wireless charging platform has been constructed on a solar powered vehicle that allows the drone to virtually recharge an unlimited number of times. Moreover, a control strategy is proposed to manage the quadcopter landing, charging, and takeoff processes autonomously. Usually, the UAV uses the estimated GPS data to reach roughly the charging platform. Therefore, the UAV has been equipped with an Infra-Red (IR)-Lock sensor to increase the potential of automatic landing within a very precise area. The proposed system has been implemented and tested. Many experiments show that the proposed outdoor positioning and charging approach is valid and effective for charging an UAV that performs frequent missions in remote areas.

Technical Session 2

Topic: Mechatronics and Industrial Automation

Time: 14:00pm - 16:15pm (October 12, 2019)

Venue: Cracow II -2nd Floor

Session Chair:

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ES110

14:00-14:15

Title: A Novel Varying Angle Fiber-reinforced Elastomer as a Soft Pneumatic Bending Actuator

Sivakumar Kandasamy, Harish Devaraj, Logan Stuart, Andrew McDaid and Kean C. Aw

The University of Auckland, New Zealand

Abstract: Soft actuators are inherently compliant, highly dexterous and an extremely lightweight alternative that are progressively replacing traditional electromechanical actuators in a wide range of robotic applications that involves close interaction with humans. This research aims to demonstrate the bending characteristics, and the force response achieved by a soft pneumatic actuator made from a unique fabrication technique; namely continuous fiber reinforcement technique (CFR) to create a fiber braiding, which is significantly simpler than the previous work, which we named as split fiber reinforce technique (SFR). The performances of SFR and CFR were compared. The active layer was a highly elastic material that can stretch up to 900% of its original length without losing its elasticity. Thus, the actuators' angular profiles were improved by a factor of 89% & 92% for the SFR and CFR respectively than that of the benchmark. The CFR actuator in particular was demonstrated to be capable of exerting blocking force of up to 1.63 N at just 30.75% of the

input pressure compared to the benchmark actuator, while the SFR was capable of exerting a slightly lower 1.5 N of force beyond which pressurization gave way to lateral expansion. The bending capability and compliance of these varying angle fiber reinforced elastomer-based soft pneumatic actuators shows high potential for implementation in human-centric body powered robotic actuation tasks for rehabilitation and other delicate industrial grasping tasks.

ES118

14:15-14:30

Title: Designing PSO-Based PI-type Fuzzy Logic Controllers: A Typical Application to Load-Frequency Control Strategy of an Interconnected Hydropower System

Duy-Trung Nguyen; Ngoc-Khoat Nguyen; Hung-Lan Le and Van-Tiem Nguyen

Electric Power University, Vietnam

Abstract: Recently, a fuzzy logic technique – based control strategy has become one of the most efficient control schemes in dealing with complicated and nonlinear control systems. The working principle of a fuzzy logic controller (FLC) is based on experiences of experts, thereby it should be one of the artificial intelligence controllers which can efficiently replace with conventional regulators. This paper concentrates on the design of a typical PI-type FLC incorporation with the particle swarm optimization (PSO) technique. The PSO algorithm is used to successfully determine three scaling factors of the PI-type FLC, thereby the proposed control strategy will be able to obtain much better control performances in comparison with the conventional regulator and/or the FLCs applying the other optimization counterparts, i.e. genetic algorithm (GA) and differential evolution (DE) algorithm. This study also investigates feasible solutions for the load-frequency control (LFC) problem of an interconnected hydroelectric power system. In fact, the LFC problem is one of the most important control issues of multi-area interconnected hydroelectric power systems. Comparative simulations with conventional PID regulators, PD-type FLC, GA- and DE-based PI-like FLCs will be implemented in this study to demonstrate the effectiveness of the proposed PSO-based PI-type FLC. The control quality of the proposed control approach revealing through major control criteria obtained, such as overshoots, steady-state error and settling time, is much better than that of the other controllers for solving the LFC problem of a hydropower system.

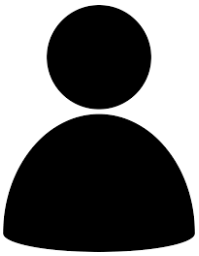
ES008

14:30-14:45

Title: Portable Rotary-angle Detector for Industrial Motor Inspection

	Tsung-Han Hsieh; **Jr-Rung Chen;** Po-Er Hsu and Bing-Lin Ho **Industrial Technology Research Institute, Taiwan**

Abstract: Several types of precision equipment, such as machine tools and robot arms, rely on precision rotary motion. In this study, we developed a portable rotary-angle detector (PRAD) comprising five optical sensors and one angle ring with a 57-mm diameter to measure the positioning and radial errors of rotary motions. The five optical sensors were installed at equally divided intervals around the angle ring according to the equal division averaged method (EDA-Method) implementation. The grating of the angle ring has 9000 lines, and the signal interpolation of the angle detector system has 4000-fold subdivision. Therefore, the PRAD resolution can be achieved at 0.036 arcsec. Furthermore, a 12-face polygon and an autocollimator with 0.05-arcsec resolution and 0.25-arcsec accuracy were used to check the PRAD performance. The experimental results showed that the structure of the PRAD is simple. However, the difference over 360° is only 0.7 arcsec, indicating that PRAD is suitable for motor inspection in machine tools or robot arms.



ES012

14:45-15:00

Title: Tests of Electrical Motor for Installation in the Wheel Hub of an Electric Car

Tomasz Jarek, Bartlomiej Bedkowski, Piotr Dukalski and Tomasz Wolnik

Łukasiewicz Research Network - Institute of Electrical Drives and Machines KOMEL, Poland

Abstract: The article presents the construction of test stand for testing an electric permanent magnet synchronous motor (PMSM) with an external rotor. The results of laboratory tests such as temperature rise tests for various motor parameters (such tests allow to determine temperatures in important motor components during different driving conditions - calculated for Fiat Panda III) and load tests with the determination of efficiency maps in the entire range have been presented. It was assumed that the car's drive is fitted with two motor in the rear axle.

ES106

15:00-15:15

Title: Distributed Manufacturing: A Vision about Shareconomy in the Manufacturing Industry

Carsten Ellwein, Alexander Schmidt, Armin Lechler and Oliver Riedel

	University of Stuttgart, Germany

Abstract: Four major trends in recent manufacturing technology have been identified and are introduced. Those trends are mass customization, shareconomy, digitalization and cloud manufacturing. The impact of those trends on manufacturing paradigms has been evaluated and three possible paradigms have been identified. Those manufacturing paradigms are separation of design and manufacturing, collaboration across company borders and on-site production. The separation of design and manufacturing does empower customers with regard to the product and does allow true mass customization where customers are included in the product description process. The collaboration across company borders does empower customers in regard of the process and lets them choose their contractual partner for every production step. The following on-site-production focuses on the throughput and thus on the delivery time by re-location of the production into the end-customers' daily field of action. Each paradigm is explained, the vision of possible future implementations is drawn and the possible benefits are outlined. However, the technical realization of those paradigms is yet not fully feasible due to still unsolved problems and challenges. Therefore, a research agenda has been composed to list and address those deficits. The main deficits that have been identified are the lack of standardized data models, an integrated and automated toolchain, the protection of intellectual property and the compliance with quality demands.

ES107

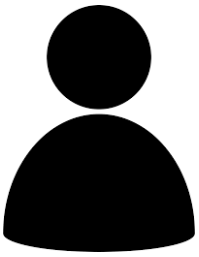
15:15-15:30

Title: Shape Optimization Technique in 3D printing

Md. Hazrat Ali, Temirlan Otepbergenov, Sagidolla Batay and Syuhei Kurokawa

Nazarbayev University, Kazakhstan

Abstract: The emergence of additive manufacturing technology allowed prototyping the complex 3D shape models. Fused Deposition Modeling (FDM) method in 3D printing is the most widespread material extrusion technology that has a great potential to further advance in better quality, low-cost, material, and time optimization. This paper discusses and compares the methods of shape optimization for various models of 3D printed pressure vessels, such as Cylindrical, peanut, pumpkin, and honeycomb, in terms of weight and stress distribution, through FEA simulation in ANSYS software by applying pressure up to 100 MPa inside the vessel. Some optimized shapes of pressure vessels were obtained with uniformly-distributed stress all over the vessel body due to the removal of the less useful parts of the vessel. The most lightweight was peanut-shaped modified cylindrical pressure vessel, which resulted in a 9.81% weight reduction after applying shape optimization method and the least average stress undergoing vessel was simple cylindrical pressure vessel. The simulation results show that the developed technique has a great prospect of possible application in additive manufacturing technology.



ES102

15:30-15:45

Title: A Modeling and Simulation Approach for the Design of Linear Feeding Systems in Industrial Automation

Markus Schörgenhumer, **Simon Schiller,** Dominik Perchtold and Daniel Six

Linz Center of Mechatronics GmbH, Austria

Abstract: The optimal design of linear feeding systems, individually tailored to the parts to be processed, is still a considerable challenge in today's industrial automation. Overall objective is to optimize the throughput of correctly sorted and aligned parts, depending on the individual geometries as well as various material and system parameters. In this work, we present an approach for the modeling and simulation of such feeding systems with focus on the parts' transport process, and illustrate its potential to support the design phase of vibrating conveyors by an exemplary test case.

ES104

15:45-16:00

Title: Method of Industrial Automated Optical-electronic Control of Granulometric Composition of Mineral Fertilizers

Yunovidov D.V., Shabalov V.A. and Sokolov V.V.

JSC "NIUIF", Cherepovets State University, Russia

Abstract: The article describes the solution of the operational control problem of particle size composition of industrially produced mineral fertilizers by the optical-electronic method. The device and algorithm for automated online control in industrial conditions is proposed. This scheme consists of three independent parts: the system of sampling from the conveyor belt, the system of sampling in the field of analysis (feeder) and the block of optical-electronic detection of granules. The peculiarities of the proposed scheme include online control of the fraction of granules (granulometric composition, which was calibrated by mass or optical distribution) and several abilities (to analyze the shape and color of granules; to work in industrial conditions and to transfer data into the factory information system – "PISystem"). Sampling from the conveyor belt is carried out by a robotic rotary system. The transfer of the sample to the analysis area was performed by the linear vibrations of the sample feed system. The integrated computer controls the entire sampling and feeding scheme. Furthermore, the algorithm for calculating parameters of granules was developed. It consists of obtaining an optical-electronic image (three-dimensional Red-Green-Blue matrix of pixel intensities), image pre-processing (smoothing, binaryization and morphology), calculation of closed

contours, approximation of the found contours by ellipses and calculation of ellipse parameters (long and short axis, axis ratios, average color). All stages of receiving and processing of the information are automated and implemented on programming language Python 3.7. Statistical indicators of the proposed method are calculated and the results are compared with the laboratory techniques of granulometric composition analyses. The linear correlation map of different parameters of technological process (calculated granulometric composition, raw material consumption, work of drum dryer-granulator, vibrating screen and crushers) is given.

ES013

16:00-16:15

Title: Study of filler effect on dielectric strength of epoxy insulator using artificial neural network

Fatmaelzhraa Soliman Mostafa Soliman, Loai Nasrat and Eman Beshr

Arab Academy for Science, Tech. & Maritime Transport, Egypt

Abstract: The purpose of this study is to enhance electrical properties of epoxy as an insulator by adding different percentages of inorganic filler. The epoxy composites are prepared with different concentrations of filler up to 40%. This given study utilizes titanium dioxide Tio2 in micro-sized to be used as a filler. The electrical properties of the composites under study are tested. Different composites with different percentages of filler are tested to determine the most suitable percentage of filler. The effect of different types of climates are to be considered by measuring the dielectric strength of composites under test at different temperatures. Here each test is repeated ten times on each sample under the same conditions to guarantee the accuracy of the results. This study investigates how the dielectric strength of the epoxy composites is affected by adding inorganic filler and the increasing in temperature. Results showed that the dielectric strength of the epoxy insulator is improved by adding filler. Artificial neural network in regression scheme as a tool in matlab is used to calculate the dielectric strength of the composites.

Technical Session 3

Topic: Signal Processing and Control System

Time: 16:30pm - 18:45pm (October 12, 2019)

Venue: Cracow I -2nd Floor

Session Chair:

Note:

* The certificate of Oral presentations will be signed by the chairman at the end of each session.

* To show the respect to other authors, especially to encourage the student authors, we strongly suggest you attend the whole session; the scheduled time for presentations might be changed due to unexpected situations. Please come as early as you could.

* Session Photos will be taken at the end of each session, and the photos will be updated on the conference website later.

ES101

16:30-16:45

Title: Connected Vehicle: Monitor Automotive Embedded Systems via IoT Protocol UI

Shaik Arif, Austin Kane, Kumar Yelamarthi, Frank Walsh and **Ahmed Abdelgawad**

Central Michigan University, USA

Abstract: The Internet of Things (IoT) is a network of smart objects which are embedded with sensors, microcontrollers, communication protocols, and software, which helps these smart objects to share or exchange the data remotely. The Machine-to-Machine technology in IoT leads to a more comfortable lifestyle. The fundamental purpose of this project is to design, implement and refine an IoT based system to monitor automotive embedded systems. And the primary focus of the project is to alert the owner from potential risks to their vehicle as quickly as possible when it is parked. Specifically, in this paper, a novel automotive security system is designed using a Raspberry Pi (or other microcontroller breakout board), sensors and use IoT protocols to monitor any alarms from a mobile device.

ES109

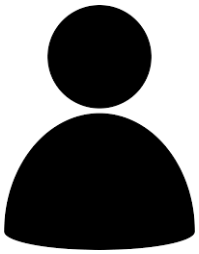
16:45-17:00

Title: Detection and Parameters Estimation of Moving Objects via Video Surveillance

Ivan Garvanov and **Vladimir Ivanov**

Institute of Information and Communication Technologies, Bulgaria

Abstract: The article proposes an algorithm for processing video information obtained from traffic monitoring in order to automatically detect moving objects and evaluate some of their parameters. The algorithm automatically detects passing vehicles, and evaluates their dimensions, speed and direction of movement. The algorithm does not require large computational resources and can work in real time. It is proved on the real video traffic records and the results of the examination becomes very close to the real ones. It is applicable in smart traffic management systems with CCTV. In the future, the algorithm will be extended with capabilities for cars recognition and their license plates identifying.



ES117

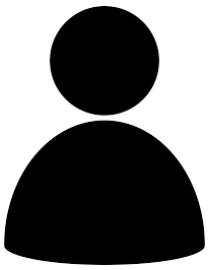
17:00-17:15

Title: Obtaining the Data for Formation of 3D Road Scene from the Radar Data

Artem V. Averin, **Ivan A. Kostin** and Nikolay V. Panokin

National University of Science and Technology "MISIS", Russian Federation

Abstract: This paper considers the problems of designing of technical vision systems based on millimeter radar technology. The architecture of the software for simulating the millimeter radar operation using mathematical models that simulate various objects of the road scene is considered. 3D road scenes of various configurations, taking into account the impact of the underlying surface have been studied. The possibility to classify the road obstacles and mobile agents of the road scene has been shown by analyzing the radar data from a car radar.



ES121

17:15-17:30

Title: Simultaneous State and False-Data Injection Attacks Reconstruction for NonLinear Systems: an LPV Approach

Souad Bezzaoucha and Holger Voos

Presenter: Manuel Castillo Lopez

University of Luxembourg, Luxembourg

Abstract: The present contribution addresses simultaneous state and actuator/sensor false-data injection attacks reconstruction for nonlinear systems. The considered actuator/sensor attacks are modeled as time-varying parameters with a multiplicative effect on the actuator input signal and the sensor output signal, respectively. Based on the sector non-linearity approach and the convex polytopic transformation, the nonlinear model is written in a Linear Parameter-Varying (LPV) form, then an observer allowing both state and attack reconstruction is designed by solving an LMI optimization problem.

ES125

17:30-17:45

Title: Segmentation of Very Sparse and Noisy Point Clouds

Patrick Fleischmann and Karsten Berns

TU Kaiserslautern, Germany

Abstract: This paper summarizes an approach to segment 3D point clouds into drivable ground and obstacles. It was developed for outdoor Time-of-Flight cameras which only provide very sparse data. The methodology takes advantage of the matrix-like data structure of the CMOS sensor for segmentation in order to increase e ciency. Furthermore, it was tailored to handle typical o -highway characteristics with di erent slopes and can be adapted to various mounting positions and vehicle properties.

ES011

17:45-18:00

Title: Fault Diagnosis of Ball Bearing Using Hilbert Huang Transform and LASSO Feature Ranking Technique

Harshit Trusharkumar Thakker, Vipul Dave, Vinay Vakharia and

Sukhjeet Singh

Pandit Deendayal Petroleum University, Gandhinagar, India

Abstract: Bearings are one of the crucial components of any machine having rotary parts. They are employed to support and ensure smooth operations of the shafts in the rotary machinery. Therefore, any fault in the bearings can lead to a decline in the level of production and equipment. For this reason, it is important to monitor the bearing health. This paper presents a signal analysis technique for machine health monitoring using the Hilbert-Huang Transform (HHT). HHT is a time domain approach which extracts instantaneous frequency data from a signal by decomposing the signal into Intrinsic Mode Functions (IMF) using the Empirical Mode Decomposition (EMD). The Least Absolute Shrinkage and Selection Operator (LASSO) is used as feature ranking method which is used to improve the prediction accuracy by reducing input data to machine learning model by aiding to select only a subset of the feature vector rather than using all of the features. In the present work, training and tenfold cross-validation accuracy or two classifiers have been compared. The comparative analysis presented in this paper reveals that the utilization of LASSO as a feature ranking method shows a substantial decrease in the data to be handled and improving the diagnosis accuracy.

ES016

18:00-18:15

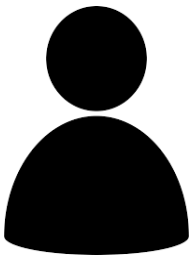
Title: On-the-fly Fingerprint Acquisition Method

Michal Dvořák, Waleed H. Abdulla and Martin Drahanský

Brno University of Technology, Czech Republic

Abstract: Biometric systems have been gaining widespread popularity in recent years. For example, fingerprint biometrics have been proliferated in many serious applications such as border control. However, despite the current fingerprint identification systems have been proven popular the necessity of physical contact with scanners, in most existing systems and the demand of stationary finger during acquisition, constraint the throughput of tested people. This limitation along with hygienic concerns calls for a system that overcomes these limitations.

In this paper, we strive to solve some of the existing obstacles by developing a fingerprint acquisition system using a contactless optical scanner. The proposed system is designed to collect the fingerprint information while the user is in motion, a so-called on-the-fly fingerprint extraction. A system has been developed to achieve this objective is introduced. The quality of the fingerprint images acquired has been assessed by using the Verifinger SDK and NFIQ quality measure standards. We show that the proposed system and approach are promising to adopt in contactless fingerprint extraction.



ES122

18:15-18:30

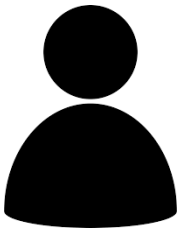
Title: On the Event-based Attack-tolerant Control: A Polytopic Representation

Souad Bezzaoucha Rebai and Holger Voos

Presenter: Manuel Castillo Lopez

University of Luxembourg, Luxembourg

Abstract: In the present contribution, we present a new event-based control representation. Based on the polytopic approach, more specically the sector nonlinear transformation, an event-based attack-tolerant control and scheduling co-design strategy is proposed. From the event triggering de nition (sample-and-hold strategy), polytopic writing of the eventtriggered feedback control is rst presented and then incorporated into the system dynamics for analysis. Our goal is to present a unique model that is able to deal with the co-design problem simultaneously and that can be handled by classical control synthesis tools. The novel representation, including data deception and attack tolerant control is formulated as a BMI optimization problem ensuring both stability and some level performance requirements (L2 attenuation of the cyber-attack).



ES119

18:30-18:45

Title: Serious Game based on Skeleton Shape Matching for Functional Rehabilitation Exercises

Mohamed Zine El Abidine Amrani and **Nouara Achour**

USTHB, Algeria

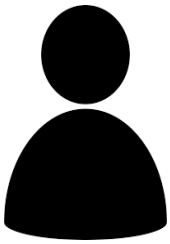
Abstract: Rehabilitation exercises are now presented as games, where the patient performs the exercises by playing video games, this kind of games are designed for a primary purpose other than pure entertainment, they are serious games. We can find in the literature some serious games for functional rehabilitation, but almost all of them are based on video recordings or images, without full body tracking. In this paper, we present an interactive serious game based on full body tracking and using virtual reality techniques. A virtual coach supervised the users and gives instructions to help user performing exercises correctly. With a group of eight players for a set of six therapeutic exercises, we have reached a high classification accuracy and positive results on the experience questionnaire.

Listeners' List

ES104-L

Maksim Nadezhin

JSC "NIUIF", Cherepovets State University, Russia



ES117-L

Artem V. Averin

National University of Science and Technology "MISIS", Russian Federation

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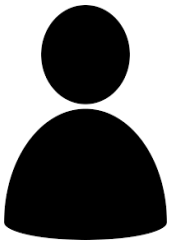

ES118-L

Ngoc-Khoat Nguyen

Electric Power University, Vietnam

ES-L10

Lifang Wen

Beijing Huazhang Graphics & Information Co., Ltd./China Machine Press, China

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ES-L11

Lei Yao

Beijing Huazhang Graphics & Information Co., Ltd./China Machine Press, China

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ES-L12

Bo Tang

Mississippi State University, USA

ES-L13

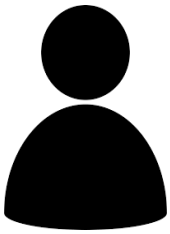
David Harrison

University of South Carolina Aiken, USA

ES-L14

Yangeun Cha

Asian Medical Center, Republic of Korea



ES012-L

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Author Index

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