COVER PAGE

ICCEE 2019

2019 12th International Conference on Computer and Electrical Engineering

TU Delft, Netherlands   November 6-8, 2019

Published by

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WELCOME

Dear distinguished delegates,

It is our great honor and pleasure to welcome you to 2019 12th International Conference on Computer and Electrical Engineering (ICCEE 2019) which is held in TU Delft, Netherlands on November 6-8, 2019. Welcome to TU Delft.

ICCEE was started in Phuket Island, Thailand in the year of 2008, and after the success of the first edition, it has been held annually from 2009 to 2018 in Dubai(UAE), Chengdu(China), Singapore, Hong Kong, Paris(France), Geneva(Switzerland), Paris(France), Barcelona(Spain), Edmonton(Canada), and Tokyo(Japan). With the successful experience over the past 11 years, we are confident that 2019 will witness an even greater success of the 12th edition of ICCEE. The conference provides a platform for scientists, scholars, engineers and students from universities and industries around the world to present exciting ongoing research activities, and hence fosters research relations between universities and the industry. This conference is now a well-known event worldwide and the number of paper submissions and attendees are increasing every year.

The evaluation of all the papers was performed based on the reports from anonymous reviewers, who are qualified in the field of Computer and Electrical Engineering. The conference committee is also honored enough to invite 4 speakers to share their researches with us. They are Prof. Peter Plapper, University of Luxembourg, Luxembourg, who will give the speech on Development of a Maturity Model for Lean and Industry 4.0 in SMEs; Prof. YangQuan Chen, MESA Lab of University of California, Merced, USA, with the speech topic of Greener Process/Motion Control Using Fractional Calculus; Prof. Georg Schitter, Vienna University of Technology, Austria, with the topic of Integrated System Design and Control of Mechatronic Imaging Systems and Asst. Prof. Dr. Rafiq Ahmad, University of Alberta, Canada with the topic of Enable Industry 4.0 in manufacturing by supporting intelligent problem solving. We believe these talks will be of a great impression and a spark for all the conferences attendees.

Here we'd like to express our heartfelt appreciation to our chairs, technical program committee members, organizing committee members, authors and delegates, who all have contributed a lot to this conference. Thanks to your support and help, the conference can be held successfully and be raised for increasing concern year by year.

We believe that by this excellent conference, you can get more opportunity for further communication with researchers and practitioners with the common interest in this field. Obviously, your suggestions are warmly welcomed for the further development of the conferences. Wish you will enjoy this conference, contribute effectively toward it and take back with your knowledge, experiences, contacts and happy memories of these days. Thank you for your attention!

We look forward to meeting you again next time.

Yours sincerely,

ICCEE2019
Organizing Committee

AGENDA OVERVIEW

November 6, 2019 (Wednesday)

10:00-17:00	Registration and Collection of Badges Opens	Venue: Delft University of Technology, Science Center Delft Mijnbouwstraat 120, 2628 RX Delft

November 6, 2019 (Wednesday)

10:00-12:00	Lab Tour	TBA-TU Delft
13:00-13:30	Opening Ceremony	Mekelrooms 2
13:30-14:30	Plenary Session 1	Mekelrooms 2
	Prof. Peter Plapper University of Luxembourg, Luxembourg	
14:30-17:45	ICCEE2019-SESSION 1	Mekelrooms 4
17:45-20:30	Reception	Lagerhuysch, Mekelweg 2, 2628CD, Delft

November 7, 2019 (Thursday)

9:00-10:00	Plenary Session 2	Mekelrooms 2
	Prof. Georg Schitter Vienna University of Technology, Austria	Mekelrooms 2
10:00-12:45	ICCEE2019-SESSION 2	Mekelrooms 4
12:45-13:30	Lunch	Mekelrooms 1
13:30-14:30	Plenary Session 3	Mekelrooms 2
	Prof. Yangquan Chen MESA Lab of University of California, Merced, USA	
14:35-15:45	Author Presentations 3	Mekelrooms 2
15:45-17:00	Interactive session	Mekelrooms 2
18:00-22:00	Gala Dinner	Address: Oude Kerk Heilige Geestkerkhof 25, 2611 Hp Delft

November 8, 2019 (Friday)

9:00-9:45	Plenary Session 4	Mekelrooms 2
	Asst. Prof. Dr. Rafiq Ahmad University of Alberta, Canada	
9:50-11:15	Author Presentations 4	Mekelrooms 2

AGENDA OVERVIEW

11:15-12:30	Interactive session	Mekelrooms 2
12:30-13:30	Lunch	Mekelrooms 1
13:30-14:40	Author Presentations 5	Mekelrooms 2
14:45-16:00	Interactive session	Mekelrooms 2
16:00-16:30	Closing Ceremony	Mekelrooms 2

VENUE

Conference Venue: Delft University of Technology, Science Center Delft

Add: Mijnbouwstraat 120, 2628 RX Delft

Reception Venue: Lagerhuysch

Add:Mekelweg 2, 2628CD, Delft

ROUTE

(i) How to get to the **TU Delft** from **Amsterdam Airport Schiphol?**

➤ **By Taxi:** 🚕 Around 40 minutes (48.5km)

➤ **Public Transport:** 🚌 Bus + 🚶 Walking------Around 63 minutes

Amsterdam Airport Schiphol (Intercity 2433 Dordrecht)---36min(4 stops)---**Delft**---1min(walk) ---

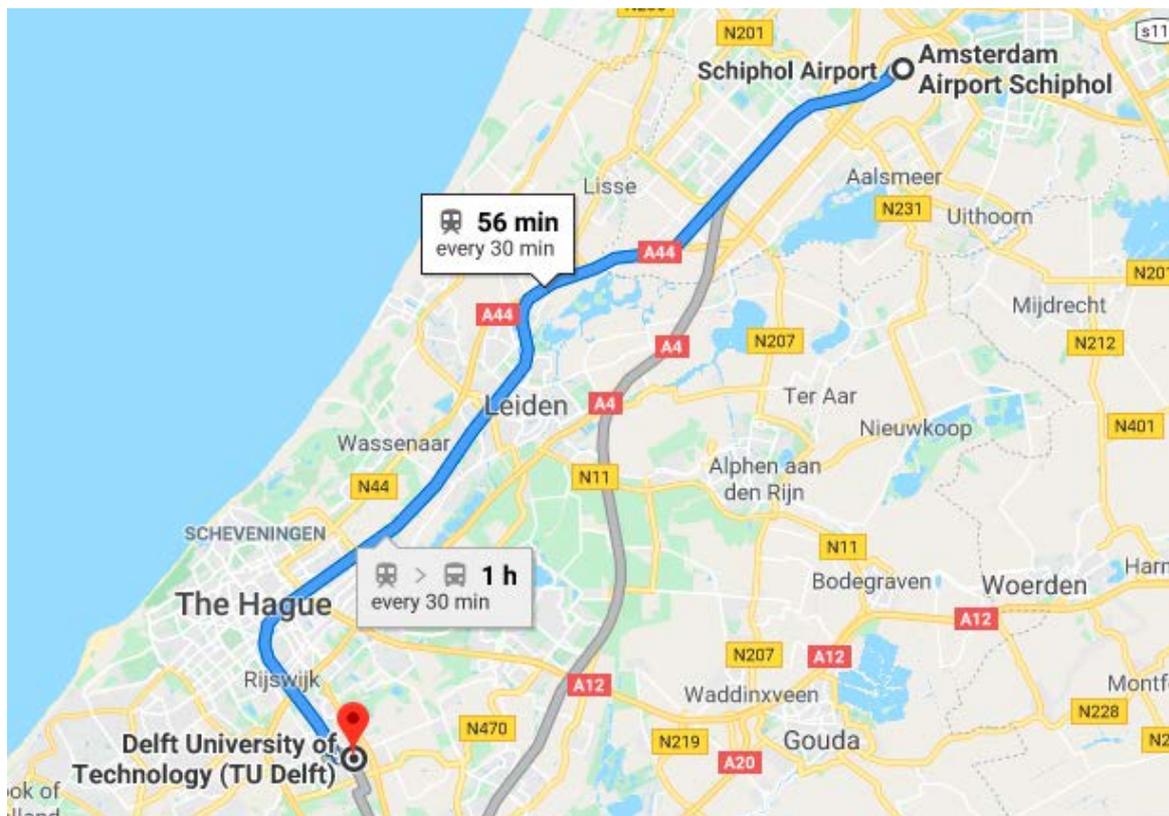**Delft, Station Delft(40 Rotterdam Centraal)**---15min(non-stop)--- **TU Aula**---1min(walk)---**TU Delft**

🕐 **Time Zone:** GMT+1

🪙 **Currency:** €

📞 **Important Phone Numbers**

Police, Fire, Ambulance and Emergency Rescue:

112

DETAIL AGENDA

[November 6, 2019 (Wednesday)]

10:00-17:00

Registration & Materials Collection

Venue: Delft University of Technology, Science Center Delft

Address: Mijnbouwstraat 120, 2628 RX Delft

Give your **Paper ID** to the staff.

↓

Sign your name in the attendance list and check the paper information.

↓

Check your **conference kit**, which includes conference bag, name tag, lunch & dinner coupon, conference program, the receipt of the payment, the USB of paper collection.

Tips for Participants

✧ Registration will last during 10:00-17:00 on November 6th along with other activities. See the details on the next page.

✧ The listeners are welcome to register at any working time during the conference.

✧ **Presentation Guideline:**

1. Get your presentation PPT or PDF files prepared.

2. Regular oral presentation: 15 minutes (including Q&A).

3. The PPT or PDF files as well as your oral presentation should be in English.

4. Please copy your PPT or PDF in the USB stick, and bring your USB to the conference, considering the internet access limitation sometimes.

✧ Please take care of your personal belongings; the organizer of the conference does not assume any responsibility for the loss of personal finances.

✧ Considering the personal and property safety of the delegates, the participants are required to enter and exit the venue wearing the conference name tag, and not to lend the name tag to others. Non-participants are not allowed to enter the conference without permission.

DETAIL AGENDA

[November 6, 2019 (Wednesday)]

10:00-20:30

⊙ Venue: Mekelrooms 2

Delft University of Technology, Science Center Delft

10:00-12:00	Lab Tour	3ME -TU Delft
13:00-13:30	Opening Ceremony	Opening Remark by **Asst. Prof. Dr. Hassan HosseinNia** TU Delft, Netherlands
13:30-14:30	Plenary Session 1 **Chaired by Dana Copot**	**Prof. Peter Plapper** University of Luxembourg, Luxembourg Speech Title: Development of a Maturity Model for Lean and Industry 4.0 in SMEs
14:30-17:15 **Mekelrooms 4**	**ICCEE2019-SESSION 1 - Computer Information Technology and Image Processing** **Chaired by Prof. Hamed Fawareh** **Zarqa University, Jordan**	
	TF2-023, TF2-010, TF2-027, TF2-017, TF2-013, TF2-024, TF2-028, TF2-3001-A, TF2-014, TF2-3002, TF2-020	
	📷 Group Photo	
17:30-20:30	**Reception at Lagerhuysch** **Address of Lagerhuysch:** Mekelweg 2, 2628CD, Delft	

DETAIL AGENDA

[November 7, 2019 (Thursday)]

9:00-22:00

⌖ Venue: Mekelrooms 2

Delft University of Technology, Science Center Delft

Morning (9:00-13:30)		
9:00-10:00	Plenary session 2 **Chaired by Just Herder**	**Prof. Georg Schitter** **Vienna University of Technology, Austria** Speech Title: Integrated System Design and Control of Mechatronic Imaging Systems
10:00-12:45 **Mekelrooms 4**	**ICCEE2019-SESSION 2- Electronics and Communication Engineering** **Chaired by Dr. Gibran David Agundis Tinajero** **Aalborg University, Denmark**	
	TF2-008, TF2-015, TF2-018, TF2-021, TF2-026, TF2-031, TF2-033, TF2-034, TF2-040, TF2-041, TF2-3003	
	📷 Group Photo	
12:45-13:30	Lunch @ Mekelrooms 1	
Afternoon (13:30-22:00)		
13:30-14:30	Plenary session 3 **Chaired by Hassan HosseinNia**	**Prof. Yangquan Chen** **MESA Lab of University of California, Merced, USA** Speech Title: Greener Process/Motion Control Using Fractional Calculus
14:35-15:45	**Author Presentations 3** **Chaired by Cosmin Copot** 17 Presentations— (3mins per presenter)	
	TF1-008, TF1-033, TF1-070, TF1-005, TF1-090, TF1-039, TF1-077, TF1-078, TF1-108, TF1-009, TF1-032, TF1-110, TF1-127, TF1-128, TF1-061, TF1-1001, TF1-113	
15:45-17:00	**Interactive session-Poster Display** (Coffee/Tea will be parallel served)	

DETAIL AGENDA

	TF1-008, TF1-033, TF1-070, TF1-005, TF1-090, TF1-039, TF1-077, TF1-078, TF1-108, TF1-009, TF1-032, TF1-110, TF1-127, TF1-128, TF1-061, TF1-1001, TF1-113
	📷 Group Photo
18:00-22:00	Dinner @ Oude Kerk Heilige Geestkerkhof 25, 2611 Hp Delft

[November 8, 2019 (Friday)]

9:00-16:30

📍 Venue: Mekelrooms 2

Delft University of Technology, Science Center Delft

Morning (9:00-13:30)		
9:00-9:45	Plenary Session 4 **Chaired by Peter Plapper**	**Asst. Prof. Dr. Rafiq Ahmad** **University of Alberta, Canada** Speech Title: Enable Industry 4.0 in manufacturing by supporting intelligent problem solving
9:50-11:15		**Author Presentations 4** **Chaired By Nima Karbasizadeh Esfahani** 17 Presentations- (3mins per presenter)
		TF1-067, TF1-119, TF1-100, TF1-129, TF1-037, TF1-034, TF1-023, TF1-085, TF1-063, TF1-111, TF1-041, TF1-017, TF1-099, TF1-064, TF1-114, TF1-025, TF1-126
11:00-12:20		**Interactive session-Poster Display** (Coffee/Tea will be served in parallel)
		TF1-067, TF1-119, TF1-100, TF1-129, TF1-037, TF1-034, TF1-023, TF1-085, TF1-063, TF1-111, TF1-041, TF1-017, TF1-099, TF1-064, TF1-114, TF1-025, TF1-126, TF1-092-A
		📷 Group Photo
12:20-13:30		Lunch @ Mekelrooms 1

DETAIL AGENDA

	Afternoon (13:30-16:30)	
13:30-14:40	**Author Presentations 5** **Chaired by Rafiq Ahmad** 16 Presentations— (3mins per presenter)	
	TF1-021, TF1-089, TF1-029, TF1-120, TF1-086, TF1-004, TF1-047, TF1-028, TF1-065, TF1-043, TF1-050, TF1-026, TF1-060, TF1-072, TF1-031, TF1-053	
14:45-16:00	**Interactive session-Poster Display** (Coffee/Tea will be served in parallel)	
	TF1-021, TF1-089, TF1-029, TF1-120, TF1-086, TF1-004, TF1-047, TF1-028, TF1-065, TF1-043, TF1-050, TF1-026, TF1-060, TF1-072, TF1-031, TF1-053, TF1-1003-A	
16:00-16:30	**Closing ceremony**	

PLENARY SPEAKER

Prof. Peter Plapper
University of Luxembourg, Luxembourg

Prof. Dr.-Ing. Peter Plapper was born in Mannheim, Germany on September 16th 1963. In 1986 he completed his studies on Mechanical Engineering / Design at TU Kaiserslautern with the degree Dipl.-Ing. His doctoral thesis at the laboratory of tool machines (WZL) of RWTH Aachen, Germany was awarded with the Borchers Medal for scientific excellence in 1993.

Since 1994, he worked for Adam Opel and General Motors in different management positions in Manufacturing Engineering (ME) with increasing responsibility. He developed innovative production technologies, implemented tool machines and coordinated the refurbishment of robotic assembly lines. From 1998 until 2002 he joined the Tech Center of GM in Michigan, USA where he shaped the global manufacturing strategy for Body Shop and General Assembly. During his industrial career he worked on many different robot applications, led the installation of assembly lines all European GM vehicle plants and was responsible as HEAD of MANUFACTURING Engineering for the equipment of all shops in plant Russelsheim. Following his assignment as MANAGER ADVANCED TECHNOLOGIES EUROPE Peter Plapper was appointed in 2010 FULL-PROFESSOR for manufacturing engineering to the University of Luxembourg.

Prof. Plapper is member of AIM (European Academy of Industrial Management), VDI (Verein Deutscher Ingenieure), and Luxembourg Materials and Production Cluster Steering Committee. Since 2014 he is the DIRECTOR of the new Master program "Master of Science in Engineering – Sustainable Product Creation". For the current list of publications please visit www.plapper.com.

Speech Title---Development of a Maturity Model for Lean and Industry 4.0 in SMEs

Speech Abstract---The concept of Industry 4.0 currently revolutionizes the manufacturing plants and challenges especially Small and Medium Size Enterprises (SMEs). Most SMEs are not ready for this ubiquitous transformation while sustaining the proven manufacturing systems, still attempting to introduce Lean Production Systems (LPS). Both, lean and industry 4.0 concepts are needed to sustain competitiveness. However, the possibilities as well as the priorities are not always known, roadmaps for such implementations are lacking. Especially small companies are looking for guidance on which measures to implement. This speech will present a method to assess the degree of lean implementation and readiness for industry 4.0 especially tailored for small/ medium companies. Based on characteristics of SMEs, gaps in existing maturity models a novel model was developed and validated. The assessment model analyses the status quo related to lean and industry 4.0 implementation. The model covers five dimensions such as strategy, design of value stream, organization, methods and tools, and personnel to evaluate an enterprise in holistic and in systems perspective. Finally, the assessment is used to identify company specific opportunities to address existing gaps and to initiate productivity enhancement measures. The future work will focus on creating roadmaps to deploy such methods and technologies in SMEs.

PLENARY SPEAKER

Prof. YangQuan Chen

MESA Lab of University of California, Merced, USA

YangQuan Chen earned his Ph.D. from Nanyang Technological University, Singapore, in 1998. He had been a faculty of Electrical Engineering at Utah State University from 2000-12. He joined the School of Engineering, University of California, Merced in summer 2012 teaching "Mechatronics", "Engineering Service Learning" and "Unmanned Aerial Systems" for undergraduates; "Fractional Order Mechanics", "Nonlinear Controls" and "Advanced Controls: Optimality and Robustness" for graduates. His research interests include mechatronics for sustainability, cognitive process control, small multi-UAV based cooperative multi-spectral "personal remote sensing", applied fractional calculus in controls, modeling and complex signal processing; distributed measurement and control of distributed parameter systems with mobile actuator and sensor networks.

Dr. Chen serves as a Co-Chair for IEEE Robotics and Automation Society Technical Committee (TC) on Unmanned Aerial Vehicle and Aerial Robotics (12-18). He recently served the TC Chair for the ASME DED Mechatronics Embedded Systems Applications (2009-10); Associated Editor (AE) for IEEE Trans. on Control Systems Technology (00-16), ISA Trans. (12-17), IFAC Control Engineering Practice (12-17), IET Control Theory and Applications (15-18) and Journal of Dynamics Systems, Measurements and Control (09-15). He now serves as Topic Editor-in-Chief of International Journal of Advanced Robotic Systems (Field Robotics), Section AE (Remote Sensors) for Sensors, Senior Editor for International Journal of Intelligent Robotic Systems, Topical AE for Nonlinear Dynamics (18-) and AE for IFAC Mechatronics, Intelligent Service Robotics, Energy Sources (Part A) (18-) and Fractional Calculus and Applied Analysis. He is a member of IEEE, ASME, AIAA, ASPRS, AUVSI and AMA. He relies on Google citation page to keep track of his publications at https://scholar.google.com/citations?user=RDEIRbcAAAAJ

Dr. Chen started some new investigations, published some papers and books, graduated some students, hosted some visiting scholars and also received some awards including the IFAC World Congress Best Journal Paper Award (Control Engineering Practice, 2011), First Place Awards for 2009 and 2011 AUVSI SUAS competitions, and most importantly, the "Relationship Counselor" award from IEEE Utah State University Student Branch for "explaining human relationship using control theory." His is listed in Highly Cited Researchers by Clarivate in 2018.

Speech Title--- Greener Process/Motion Control Using Fractional Calculus

Speech Abstract---By fractional calculus we mean that the order of differentiation/integration can be non-integer. Denying fractional calculus is like saying that there is no nonintegers in between integers. For control engineers, the fundamental question is: Can the fractional order controller really outperform its integer order counterparts under fairness consideration? We will show that fractional order proportional derivative and integral controllers (FOPID) indeed outperform integer order PID controllers (IOPID) under fairness comparison for first order plus time-delay (FOPTD) plants. It is now being accepted that the additional freedom in tuning the FOPIDs can offer a good potential to achieve better performance at the cost of extra implementation efforts. Since the embedded computing power and memory are both getting cheaper and cheaper, people are running out of excuses not to attempt FOPID in industry 4.0 era when more optimal performance is being pursued. FOPID can do better than the best of its integer order counterpart under fairness comparisons in terms of performance, robustness margins and even control energy consumption. We then focus on the energy consumption of control efforts and we make a convincing case that it is possible to achieve greener process/motion control using fractional calculus that has huge implications in many industry sectors.

PLENARY SPEAKER

Prof. Georg Schitter

Vienna University of Technology, Austria

Georg Schitter received a M.Sc. in Electrical Engineering from Graz University of Technology, Austria, and a M.Sc. and a Ph.D. from ETH Zurich, Switzerland. He was a postdoctoral fellow at UCSB (Santa Barbara, CA, USA), and an Associate Professor at Delft University of Technology, the Netherlands. Currently he is a full Professor at Vienna University of Technology, Austria, in the Department of Electrical Engineering.

He was a recipient of several prestigious fellowships and awards, among them the 2013 Young Researcher Award of the IFAC TC Mechatronics, the best paper award from the Asian Journal of Control (2004-2005), IFAC Journal Mechatronics (2008-2011), and IEEE/ASME Transactions on Mechatronics (2017). He served as an Associate Editor for the IFAC Journals Mechatronics and Control Engineering Practice, the IEEE/ASME Transactions on Mechatronics, and for the IEEE CEB. His primary research interests are on high-performance mechatronic systems and multidisciplinary system integration, particularly for precision engineering applications in the high-tech industry, scientific instrumentation, and mechatronic imaging systems.

Speech Title---Integrated System Design and Control of Mechatronic Imaging Systems

Speech Abstract---Mechatronic imaging systems, used in scientific applications as well as in the high-tech industry, demand a continuous improvement of system bandwidth and speed, range, and precision. These challenging goals can be achieved only by a proper system integration, which requires an advanced mechatronic system design and highly sophisticated motion control. Example applications for the discussed mechatronic imaging systems are atomic force microscopes (AFM), wafer scanners, scanning laser microscopy and metrology, as well as adaptive optics and satellite ranging.

To meet the demanding specifications, the final system, including all hard- and software components, has to be tailored to and optimized for each specific application. In a scanning imaging system, for example, one can consider the various ways of performing the scanning motion in the design of the mechanical structure and selection of the actuation principle. Whether system resonances have to be avoided, damped sufficiently, or even can be utilized for the scanning motion strongly depends on the mode of operation. At the same time this influences the choice of the corresponding control system for the motion control. A proper system integration that utilizes the interplay between process design and control design is key for achieving maximum performance of mechatronic systems in the high-tech industry.

This presentation addresses these challenges by illustrating examples for precision motion control of telescope systems for satellite ranging and adaptive optics for optical free-space communication, AFM imaging and nano-metrology, as well as confocal laser scanning microscopy and scanning laser metrology. Taking advantage of an appropriate system integration, the presented examples successfully demonstrate the potential to enhance the performance of mechatronic imaging systems substantially by an integrated mechatronic design approach.

INVITED SPEAKER

Asst. Prof. Dr. Rafiq Ahmad,
University of Alberta, Canada

Dr. Rafiq Ahmad is Assistant Professor in the Department of Mechanical Engineering, University of Alberta. He is the founder and director of the Laboratory of Intelligent Manufacturing, Design and Automation (LIMDA) focusing on "hybrid & Smart systems". His research interest includes smart systems design and development for Industry 4.0, hybrid-manufacturing combining additive and subtractive technologies, repair and remanufacturing, and Industrial Automation. Dr. Rafiq is a PhD in advanced manufacturing from Ecole Cenrale de Nantes, France and Master's in design and manufacturing from Ecole Nationale Superieure d'Arts et Metiers (ENSAM-Paris) France. He holds a BSc. degree in Mechanical Engineering from University of Engineering and Technology Peshawar, Pakistan. After completing his PhD, he worked at CECOS University of IT and Emerging Sciences, Pakistan for a year, after-which, he joined University of Luxembourg as a Post-doctoral fellow for a two-year working in advanced manufacturing and automation areas. Dr. Rafiq is running numerous research programs targeting the implementation of Industry 4.0 in smart manufacturing and green remanufacturing areas. Dr. Rafiq is a board member of International Society of Automation (ISA-Edmonton section, Co-UofA Student Section Advisor) and a member of APEGA and ASME. He is also an active reviewer, chair and organizer of numerous international conferences and journals.

Speech Title---Enable Industry 4.0 in manufacturing by supporting intelligent problem solving

Speech Abstract---"Sometimes you just have to jump out the window and grow wings on the way down" (Ray Bradbury). Motivation and creativity are necessary elements for growing effective wings. During problem solving in manufacturing and research to enable Industry 4.0, people often feel a lack of creativity and imagination, blocking the way forward. Whenever such a situation occurs, "thinking out of the box" is required to stimulate our imaginations and to help us come up with new and creative intuitions. Knowledge, Data and Analogies can serve as answers to such emotional difficulties which need to be collected and analyzed intelligently. Building upon personal experience with analogies and knowledge-based systems, this talk will highlight the benefits of using 'analogies', and 'out of the box thinking' for general research and engineering problems. This presentation will emphasize an analogy-application model as well as previous and on-going research problems in the context of industry 4.0 related to machine intelligence, machine design, human-robot collaboration and robot path planning.

Session 1

November 6, 2019
[Author Presentation 1]

🕐 14:30-17:15

⦿ Mekelrooms 4

Chaired by Prof. Hamed Fawareh

Zarqa University, Jordan

11 Presentations—TF2-023, TF2-010, TF2-027, TF2-017, TF2-013, TF2-024, TF2-028, TF2-3001-A, TF2-014, TF2-3002, TF2-020

TF2-023 14:30-14:45	Vascular Extraction By Using Matched Filter On Retinal Image Isoon Kanjanasurat, **Boonchana Purahong**, Chuchart Pintavirooj, Chawalit Benjangkaprasert King Mongkut's Institute of Technology Ladkrabang, Thailand Abstract-This paper presents a vascular extraction on the retinal image by using matched filter. It uses the approximation to calculate a matrix and convolved with retinal images. Also, the proposed method tested with two widely used databases, including DRIVE and STARE. The results of vascular extraction have an average accuracy of 0.944 in DRIVE and 0.936 in STARE. The sensitivity of DRIVE and STARE, which a parameter for detect vessel correctly was achieved 0.73 and 0.753, respectively. In addition, this algorithm has a high performance and fast algorithm.
TF2-010 14:45-15:00	Design And Implementation of An Android Application For Face Detection And Age Estimation Lubna Najah Rasoul, Ahmed Abbas, **Murtadha Najah Rasol** Southern Federal University, Russia Abstract-Age is an important attribute of identity and social interaction as well for medical processing. Face is consists several elements to predict the human age such as facial wrinkles and youthfulness. Age estimation from the face by intelligent human-machine interfacing is required to capture picture that may contains different parts as well the human face. In order to estimate age, we need to detect only the

	face information. This research proposes an android application to take photo for anyone using android camera or upload photo from gallery, then it will determine the age for everybody in the photo. The application can guess the physical age for the faces depends on internet servers. The application tested on many persons and the results was correct under some conditions such as (the light of picture, the normal state for face, camera accuracy), the other results was correct 90- 95% under other conditions. This application easy to use, and simply you can use it to detect the age of your friends. This proposed application can be used in security, parks and swimming pools entrances, and medical clinics
TF2-027 15:00-15:15	The Comparison of Faster R-CNN and Atrous Faster R-CNN in different distance and light condition K Srijakkot, Isoon Kanjanasurat, Nuttakan Wiriyakrieng, **Chawalit Benjangkaprasert** King Mongkut's Institute of Technology Ladkrabang, Thailand Abstract-This paper presents the comparison of Faster R-CNN and Atrous Faster R-CNN, which detection model, in the different distance and light condition. Also, the dataset for model training is COCO, and the classification model is residual network. The parameter for decision the performance of the model is Mean Average Precision (mAP). The results from an object resolution at 1024x768 of Faster R-CNN at 3 meters in the evening achieved mAP 1.000. Besides, the mAP at 5 meters and 8 meters were 0.798 and 0.760, respectively. The same resolution as previous, the results of Atrous Faster R-CNN at 3 meters in the evening presented mAP 1.000. Also, the mAP at 5 meters and 8 meters were 1.000 and 0.960, respectively. In addition, Atrous Faster R-CNN had better accuracy than Faster R-CNN with appropriate range and brightness from the period of the day for real-life usage.
TF2-017 15:15-15:30	Image Augmentation for Eye Contact Detection Based on Combination of Pre-trained Alex-Net CNN and SVM Yuki Omori, **Yoshihiro Shima** Meisei University, Japan Abstract-Making eye contact is the most powerful mode of establishing a communicative link between humans. We propose a method for detecting eye contact (mutual gaze) from images of both eyes through the combined usage of a pre-trained convolutional neural network (CNN) and a support vector machine (SVM). Neural networks are a powerful technology for classifying object images. When it comes to classification accuracy, a huge number of training samples is the key to success. The training samples are augmented by image perturbation, namely, shifting the cropping regions. A pre-trained CNN, Alex-Net, is used as the image feature extractor after being pre-trained for large-scale object image datasets. An SVM is used as the trainable classifier. Original both-eyes samples of two classes on the Columbia Gaze Data Set CAVE-DB are divided in five-fold cross-validation. Manually cropped images and automatically augmented images on the CAVE-DB are trained by the SVM. The feature vectors of the eye images are then passed to the

Session 1

	SVM from Alex-Net. We performed 5-fold t-testing on 77 images and found that the average error rate was 16.44%, and the lowest error rate of images without glasses was 8.96% with 7,850 training images of perturbation. These results demonstrate that the proposed method is effective in detecting eye contact.
TF2-013 15:30-15:45	Approach to User Interfaces Development Based On Semantic Model Of User Activity **Svetlana Alekseevna Belikova**, Yury Ivanovich Rogozov, Aleksandr Slavyevich Sviridov, Oksana Vladimirovna Shevchenko, Aleksandr Vadimovich Egorov, Larisa Victorovna Koltunova Southern Federal University, Russia Abstract-In this paper there is proposed a method of user interface design, which is based on semantic model of user activity in the domain, which is formed by the end user himself in natural language, as a source data for design. This description is further transformed into a mechanism of action, the combination of which can be called a model. Also the paper contains the analysis of possible models used in model-oriented approaches to interface development, advantages and features of the proposed model are highlighted. Based on the model in the form of action mechanisms, the user interface of the information system is formed. The paper contains the general example of the process of user interface construction.
TF2-024 15:45-16:00	Approximation of The Maximally Flat Filter By Using BÉZier Curve With An Exponential Function **Boonchana Purahong**, Isoon Kanjanasurat, Paisan Sithiyopasakul, Vanvisa Chutchavong, Chuchart Pintavirooj King Mongkut's Institute of Technology Ladkrabang, Thailand Abstract-This paper presents a design of filter by using Bézier curve with an exponential function. This paper used the advantage of The Bézier curve which had ability for approximation and an exponential function which had the adaptable parameters of the polynomial. It can adjust the characteristic of frequency response for the best performance. The simulation results of various setting show the frequency response, step response. The comparison of response between the Bernstein filter and Butterworth filter in order two show that the rise time of Bernstein filter better than Butterworth filter and Bézier curve filter has not overshoot. Furthermore, the stability Nyquist criterion has been used to guarantee the stability of the transfer function.
TF2-028 16:00-16:15	Development Architechture of Remote Laboratory as Learning Solution in Industrial Revolution 4.0 Era **F Yudi Limpraptono** National Institute of Technology Malang, Indonesia Abstract- Industrial worlds nowadays is encountering a change by entering industrial revolution 4.0 era or fourth industrial revolution where information technology has become the basis in human life. Everything is unlimited by the using of unlimited computing and data power because it is influenced by massive internet development

	and digital technology as the core of movement and connectivity of human and machines. This era is also disrupting a lot of human's activities, including science and technology and higher education. The education world has been responded the industrial revolution 4.0 by creating many learning methods, one of them is the concept of blended learning or hybrid learning which is the blend of classroom activities and online system learning. In facing industrial revolution 4.0 in education, Indonesian government has tried Cyber University program and the development of 4.0 learning, like distance learning lecturers system that is facilitated by SPADA (Indonesian online learning system) and idREN (Indonesian Research and Education Network). SPADA is a program of the Directorate General of Learning and Student Affairs of the Indonesian Ministry of Research, Technology and Higher Education to improve equitable access towards quality learning in higher education. Aggregator of the SPADA Indonesia is used to connect learning management system (LSM) of higher education and the LMS of SPADA Indonesia. Through this aggregator, the registered online lectures data and the activities will be displayed and recorded in SPADA Indonesia. The problem in SPADA and LSM system is generally in a state of having shortcomings in the learning of engineering field, where to achieve learning outcomes, it needs facilities to do laboratory work activity. Using this background, the researchers in this research is integrating between LMS and remote laboratory system. Remote laboratory is a new innovation in educational technology to support blended learning concept. It is expected that the solution of distance learning that integrated with remote laboratory can fulfill all resources needed to achieve learning outcomes education of the engineering field like in conventional learning.
TF2-3001-A 16:15-16:30	Methods for Air Pollution Prediction based on Machine Learning Approaches **Marijana Cosovic**, Emina Junuz University of East Sarajevo, Bosnia and Herzegovina Abstract- Machine learning algorithms are used for prediction tasks in various application fields. Weather forecasting, in particular air pollution forecasting, could be relying on machine learning techniques in predicting the ambient air quality. With reliable data collection process and suitable machine learning algorithms, prediction outcomes could provide dependable air pollution forecasts, as this is of significant importance to the public. We observe weather patterns as time series data containing hidden periodicities and nonlinear dependencies between features. Different methods are used for low-level and high-level air pollutants feature extraction. In addition to feature extraction process, feature selection was performed to select the most prominent features for air pollution prediction. In this paper we evaluate the performance of several linear and nonlinear modeling approaches for urban air quality prediction. Machine learning models for ambient air pollution forecasting considered in this study are Support Vector Machines (SVM), Naïve Bayes (NB), decision tree, neural networks, and ensemble methods. We observed five-year period data for several monitoring stations in the urban area. The network architecture based on multilayer perceptron (MLP), a feed-forward type of artificial neural network, along with Long

	Short-Term Memory (LSTM) units for building a Recurrent Neural Network have demonstrated the best results in prediction accuracy analysis amongst all predictors used.
TF2-014 16:30-16:45	Method of Designing The Modular Structure Of The Information System Yuri Ivanovich Rogozov, **Sergey Aleksandrovich Kucherov**, Julia Yurievna Lipko, Alexander Nikolaevich Belikov, Ameen Quaseem Maakot, Svetlana Alekseevna Belikova, Murtadha Najah Rasol Southern Federal University, Russian Federation Abstract-The overwhelming majority of modern information systems are built on the basis of a modular principle. This principle involves the creation of independent software subsystems that perform separate groups of tasks. The success of building an information system depends on the quality of the division of tasks into groups. Known approaches to modular partitioning are based on the organizational structure of the enterprise and job descriptions of employees. This leads to unmanaged intermodular connections and loss of the advantages of the modular approach (flexibility, interchangeability of modules, etc.). To solve this problem, the article proposes a new method for designing a modular structure of information systems based on the analysis of information and information flows. This allows minimizing inter-module communications and building systems that are independent of the organizational structure of the enterprise.
TF2-3002 16:45-17:00	Software Quality Model in the Presence of Culture Quality Factors **Hamed Fawareh**, Ayat Mohammad Zarqa university, Jordan Abstract-Researchers have often attempted to raise the success rate of software systems over the past century. Improve software quality models and other software elements to make it more customer satisfaction and achieve customer permanence. Several quality models and variables have been proposed to decrease software system failure and complexity. Also, several software quality models were proposed to assess the general and particular types of software products. These models have been proposed to determine the general or particular scopes of software products. The proposed models evaluate based on comparisons between the well-known models to customize the closed model. These comparisons are the leakage of criteria based on distinct views and knowledge of cultural and social requirements. A new factors proposed by the customize software quality models. The proposed cultural model has eight criterions namely: Language, Religion, social habits, publishing, custom, Ethics, and Law. We classified the new criterions factors into three main groups. The outcome of the proposed cultural model demonstrates that the eight criterions factors must be deemed to decrease the satisfactions of software failure and permanence variables. Finally we proposed a cultural language metric for measuring the satisfactions of software failure and permanence variables.
TF2-020 17:00-17:15	A Quad-Band Slot Antenna With Spiral Stub And Interdigital CPW Feed **Tuanjai Archevapanich**, Pongsathorn Chomtong, Prayoot Akkaraekthalin

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Rajamangala University of Technology Suvarnabhumi, Thailand

Abstract-This paper proposes a quad-band slot antenna with spiral stub and interdigital CPW feed. The antenna has a compact size and can be used for four frequency bands of 1.8 GHz, 2.45 GHz, 3.7 GHz and 5.2 GHz applicable for LTE, WiMAX and WLAN systems. The important technique designs of the proposed antenna are divided into 2 parts. The first part includes the stepped slot antenna added with square-shaped spiral stub. As a result, the resonance frequencies of the third and fourth harmonics can be controlled as desired. For the second part, the technique of interdigital capacitive CPW is employed at the feeding line, resulting in length reduction from $\lambda/4$ of the conventional one to $\lambda/8$, which is caused by the slow-wave effect. Moreover, with this technique the resonance frequency of the second harmonic can be independently controlled. The optimized antenna has good performances for all frequency bands with bandwidths of 190 MHz (1.72 GHz-2GHz) at 1.8 GHz band, 280 MHz (2.34GHz-2.53GHz) at 2.45 GHz band, 410 MHz (3.54 GHz-3.95 GHz) at 3.7 GHz band and 220 MHz (5.10 GHz-5.32 GHz) at 5.2 GHz band, respectively.

Session 2

November 7, 2019
[Author Presentation 2]

🕐 **10:00-12:15**

📍 **Mekelrooms 4**

Chaired by Dr. Gibran David Agundis Tinajero

Aalborg University, Denmark

11 Presentations—TF2-008, TF2-015, TF2-018, TF2-021, TF2-026, TF2-031, TF2-033, TF2-034, TF2-040, TF2-041, TF2-3003

TF2-008 10:00-10:15	Study on the Calculation of Cable Emergency Current Capacity Based on Real-time Measurement Data **P Y Wang**, Z F Xu, T Xu, H R Li, L R Lai and G Liu South China University of Technology, China Abstract-In actual operation, the cable may bear extra load due to other line faults within a certain time. This load is called the emergency Current Capacity, and this time period is called the emergency time. There are two main ways to solve the emergency Current Capacity using the thermal circuit. One is to take the surface temperature of the cable outer sheath as the boundary of the transient thermal circuit, without considering the influence of laying environment. The other is to use the environmental thermal parameters recommended by IEC standard. Since the actual environment along the cable is complex and changeable, and the environmental thermal parameters are time-varying, both methods will cause errors. In this paper, the environmental thermal parameters are calculated by using the data obtained from the real-time measurement, which is then substituted into the derived formula to obtain the emergency Current Capacity algorithm. The correctness of the algorithm is verified by comparing the results with the ones of FEA simulation and IEC. The results show that: the algorithm proposed in this paper is safe and more accurate. The effects of initial load and emergency time are also be analysed at the same time.
TF2-015	Power Flow Model with Flat Frequency Control and Load Characteristic for Voltage

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10:15-10:30	Stability Indices **Abraham Lomi**, Awan Uji Krismanto, Fransiscus Yudi Limpraptono, Irrine Budi Sulistiawati, Kartiko Ardi Widodo National Institute of Technology, Indonesia Abstract- The growing of power systems with massive interconnection becomes more complicated for reliable and economical operation under dynamic as well as steady-state operating conditions. Therefore, it is desirable to develop techniques for evaluating the voltage stability condition with the implementation of the voltage stability index and the minimum singular value of the system. This paper proposes an approach a model of power flow incorporating the generator controls with considering load characteristics of flat frequency control (FFC) scheme in large interconnected power systems. Results on a 24-Bus EHV practical system is presented for illustration of power flow solution.
TF2-018 10:30-10:45	PID Controller Parameters Enhanced Founded On Artificial Fish Swarm Algorithm **Bonzou Adolphe KOUASSI**, Yiming ZHANG, Mesmin Junior MBYAMM KIKI, Sie OUATTARA Beijing University Of Technology, China Abstract-Optimization issues are of great importance to both the industrial and scientific worlds. Artificial Fish Swarm Algorithm (AFSA) is a clever optimization algorithm founded on a behaviour inspired by the nature. The enhanced artificial fish swarm algorithm (EAFSA), settled on chaotic model, is applied to optimize the Proportional Integral Derivatives PID parameters, which increases the dynamic of the tuning mechanism and improves its fundamental behaviour. The simulation results show that this optimization algorithm gives faster response, shorter adjustment time and smaller overshoot.
TF2-021 10:45-11:00	Performance Evaluation of Power Swing Blocking in Compensated Transmission Lines **Alkım Çapar**, Ezgi Ünverdi, Ayşen Basa Arsoy Kocaeli University, Turkey Abstract-Traditional and modern compensation devices can increase power flow limit and enhance voltage drop in transmission lines. However, these systems can cause to malfunction of distance relays utilized to protect transmission lines. While compensation devices can effect distance relay operation, some disturbances like power swings are significant risk to ability of distance relays to distinguish faults. Power swing blocking (PSB) methods are used to discriminate faults from power swings. This study focuses on efficiency of conventional PSB methods when transmission lines are compensated with various compensation devices such as series capacitor (SC), thyristor-controlled series capacitor (TCSC) and static VAR compensator (SVC). A test system is simulated on PSCAD under various operating conditions. Conventional PSB methods (swing center voltage, reactive power change and change rate of impedance) are tested under these scenarios. The study revealed that compensation devices significantly affect the accuracy of PSB algorithms,

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	therefore it is recommended to develop an adaptive PSB method to block power swing in the case of various operating conditions.
TF2-026 11:00-11:15	Evaluation of WSN's Resilience to Challenges in Smart Cities **Sarah Lafi Aljohani,** Mohamed J. Alenazi King Saud University, Saudi Arabia Abstract-Smart cities are considered to be one of the most important applications of the IoT notion. Most smart city applications rely fundamentally on ubiquitous sensing, enabled by Wireless Sensor Network (WSN) technologies. These sensor networks are vulnerable to different challenges that cause failures in some parts of the network, which in turn interfere with the availability of network services and weaken the user experience. In this paper, we introduce a graph-theoretic model of wireless sensor networks used in smart cities. Moreover, we present several challenges, such as natural disasters and random failures and evaluate the system's performance in terms of data delivery, end to end delay, and energy consumption. The evaluation results show that fire is the challenge that causes the most damage among the three challenges examined, while random failure has the least effect on network performance. The results also show that the modeled WSN's can cope well with the challenge of random failures.
TF2-031 11:15-11:30	Performance Assessment of the RTDS/RSCAD VSC Model **Gibran David Agundis Tinajero**, Josep M. Guerrero, Juan Segundo Ramírez,Aarón Esparza Gurrola Aalborg University, Denmark Abstract- This document presents a performance assessment of the three-phase two-level voltage source converter (VSC) model of the real-time digital simulator RTDS/RSCAD. This evaluation is conducted through two case studies. One case is a simple two-bus power electronic-based system, and the second case is a three-bus system with a frequency-dependent transmission line model and a closed-loop controlled VSC with communication delay. The results obtained reveal that the RTDS/RSCAD VSC model presents some issues on stability, harmonic spectrum, ripple, and power quality in general, as compared with the PSCAD VSC solutions. These results also suggest the need for better power electronic components models.
TF2-033 11:30-11:45	Modelling of High-Speed Railway Traction Power Supply Systems Based on Subspace Identification **Danyi Wu**, Lei Ma, Shaokun Cheng School of Electrical Engineering, Southwest Jiaotong University,China Abstract. In this paper, reduced mathematical models for high-speed railway traction power systems based on subspace identification method (SIM) are proposed. SIM applies reliable algebra tools to estimate state variables, and then provides an analytic representation for the identified systems, especially those of large dimension. Accuracy for identification results of different orders is discussed, under both normal operation and fault cases. With appropriate accuracy-simplicity

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	trade-off, a uniform order decision is deduced. Reduced models derived from identification could be used for further studies of network-side impact on train-network coupling problems.
TF2-034 11:45-12:00	Position Measurement System Based on Image Trajectory Tracking Control of Directional Conveyor **SUPPACHAI HOWIMANPORN** King Mongkut's University of Technology North Bangkok, Thailand Abstract-This paper proposes a control trajectory tracking of direction angle conveyor using image possessing. Conveyor directional is one of the most important topics in classification products. Generally, the other systems cannot be aware of real-time detection and high precision for angle tracking of object works classification. Currently, image detecting and processing systems are widely used and becoming to applying for control field in the future trend. This work installs camera webcam for visual recognition system based on using MATLAB to determine angle position and visual processing, which can recognize the area and calculate the current position of object work, incomplete angle position, and complete angle position. In the paper focus detecting directional angle to trajectory tracking of adaptive control is also responsible for enhancing angle precision between object product and position setpoint target, closed-loop control and tracking error method are designed and implemented on the programmable logic controller (PLC) for improving the efficacy of the conveyor system. The experimental close loop control presents the capability to maintain the setpoint angle position. and the adaptive error tracing with superior response of error controller. The adaptive error tracking gains using a proportional controller. The angle position control from this proposed technique can operate on the different target setpoint and improve efficiently control the directional conveyor.
TF2-040 12:00-12:15	Using Social Media in Open Innovation: Opportunities and Challenges **Seyed Hamed Ghanadpour**, Sajad Shokouhyar Shahid Beheshti University, Iran Abstract- Open innovation is relatively a new category in organizations. Organizations are encouraged to share their R&D infrastructure in open innovation approach and attach other's R&D and innovation to their own value chain through creating technical platforms or joint ventures. Social media is one of the tools of communication in the current business world. Social media creates a platform for cooperating and encouraging people for social activities. Considering the expanded role of social media in encouraging participation and gaining external knowledge in an organization, research is missing in this relationship. Papers dealing with social media and open innovation are really limited. So, in the current research, we study the results of using social media in open innovation. As there are limited researches, it is difficult to base a research project on available studies. So we study this area by deductive approach, Delphi method. In order to do so, we collected ideas of 12 experts from fintech industry and prioritized and analyzed them with the Delphi method and finally reached to 16 opportunities and 21 challenges. From experts'

	point of view, the most important opportunities are increasing the number and quality of received ideas. The most important challenges are creating new methods for receiving ideas to decrease unrelated content and information validation, and legislation. Finally we categorized the opportunities and challenges and presented them as a framework and model.
TF2-041 12:15-12:30	Renewable Energy Generation and Impact on E-Mobility **Sree Lakshmi Gundebommu,** Olena Rubanenko, Iryna Hunko University of West Bohemia, Czech Republic Abstract-This paper gives information about Renewable Energy Generation and its impacts on E-Mobility. By 2050, the two pillars of modern transformation are E-Mobility and Renewable Energy. This transformation requires adaptation to meet demographic and economic growth without increasing pollution and congestion. The modern world needs affordable, secure and inclusive, sustainable and integrated with customer-centric infrastructure and services. There is a great fundamental change needed in road transportation sector, which is to achieve its objective of a long term transition to a low-carbon economy. Electric Vehicles when charged with the electricity generated from Renewable Energy Sources can reduce future emissions of greenhouse gases and air pollutants from road transport. Electric Vehicles combined with renewable energy paint a different picture from the oversimplification of gas miles versus electric miles. Smart Mobility and Smart Grid technologies make people live more sustainable and efficiently.
TF2-3003 12:30-12:45	Advantages and Challenges of Digital Information at The Intersection of Social Networks And Enterprise Social Networks And Supply Chain Management **Abdollhay Hamidreza**, Shokohyar Sajjad Shahid Beheshti university, Iran Abstract-The present paper aims to improve the way in which opportunities and challenges of SN systems are grasped in organizational context in order to share knowledge within and out of the organization, while enhancing their influence staff productivity. Organizations have to go beyond their boundaries to obtain the required skills and technologies for their survival in the contemporary competitive context. Among these, supply chain management and social networks can be mentioned as two prevalent concepts. Different studies have been performed on supply chain management (SCM); however, the role of social networks in enhancing the use of information in supply chains has been almost neglected. The present study aims to investigate the probable effects of social networks on the use of information in organizational and supply chain contexts consequently have a contribution to the theoretical development. Understanding of the opportunities and problems resulted from the application of SN in SCM is facilitated through this exploratory study. Information, used in the present study, was collected from different text books and articles along with several companies and a variety of valid references.

Session 3

November 7, 2019
[Author Presentation 3]

🕐 14:35-17:00

📍 Mekelrooms 2

Chaired by Cosmin Copot

20 Presentations—

TF1-008,TF1-033,TF1-070,TF1-005,TF1-090,TF1-039,TF1-077,TF1-078,TF1-108,TF1-009,TF1-032,

TF1-110,TF1-127,TF1-128,TF1-061,TF1-1001,TF1-113,TF1-037,TF1-106-A,TF1-1003-A

TF1-008	Theoretical Modeling and Efficiency Improvement of Electrically Activated Rotation-flow Gripper **Kaige Shi** and Xin Li Zhejiang University, China **Abstract**—An electrically activated rotation-flow gripper uses rotating airflow to generate negative pressure and suction force on a workpiece. The rotational flow is directly driven by a fan connected to an electrical motor, so the gripper only consumes electrical power. Because the centrifugal force generated by the rotating flow helps prevent vacuum leakage, the gripper can handle workpieces with rough and uneven surfaces. In this study, the torque to drive the rotational flow in the rotating chamber and the suction force generated by the gripper are modeled, based on which the efficiency of the gripper can be obtained. The theoretical model shows efficiency could be improved by decreasing the suction force and increasing the size of the gripper. It is also found that adding a disc at the top end of the fan can improve the efficiency of the gripper by 35%. The disc could transform the flow between the fan and the upper shell wall into a turbulent plane Couette flow, thus reducing the driving torque by 24%. In addition, the disc isolated the insufficiently rotating flow

	near the upper shell wall from the sufficiently rotating flow below it, thereby further increasing the efficiency by increasing the suction force. The theoretical model and the efficiency improvement are verified by experiments.
TF1-033	System Identification-Based Dynamics Control For X-Y Pedestal Satellite Antenna **Baris Aykent**, Kadir Koca, Mustafa Celik PROFEN Communication Technologies& Services, Inc., Turkey **Abstract**—Subspace method-based system identification and six different transfer functions as product of this method have been developed and embedded in the motion control unit of the X-Y pedestal satellite antenna. Fit estimation data of these six transfer functions is changing from 95.46% to 99.99% with a RMSE (root mean square error) degree from 0.00502 to 0.00984, whereas the target RMSE degree value is 0.05.
TF1-070	On Practical Input-Output Finite-Time Stability Based on Principle of Self-Support Tian Feng, Baowei Wu, **YangQuan Chen** University of California Merced, USA **Abstract**—In this paper, based on the principle of self-support (PSS) and an existing definition of input-output finite-time stability (IO-FTS), a totally new concept which is defined as practical input-output finite-time stability (PIO-FTS) is proposed. First, the concept of PSS is reviewed and a theorem about tracking in the practical sense is listed by virtue of robotic system. Second, two different design algorithms for controller gain are presented to illustrate the effectiveness of the PSS. Finally, by introducing the existing definition of the IO-FTS, which is used to quantify the input-output behavior of the dynamics within a prescribed finite time interval, a framework about combining the PSS with IO-FTS is given to guarantee the approximate asymptotic tracking of control systems in a finite time.
TF1-005	Nonlinear Model Predictive Control of Robot Manipulators Using Quasi-LPV Representation **Mojtaba Esfandiari**, Sonny Chan, Garnette Sutherland, David Westwick University of Calgary, Canada **Abstract**—Nonlinear optimization techniques often suffer from time-consuming computational load, which impedes them to be implemented as controller of fast plans, or when a fast action like trajectory tracking is required. In this paper, a Nonlinear Model Predictive Control (NMPC) approach is used to perform the trajectory tracking problem in a robot manipulator in the presence of input saturation and un-modeled dynamics, using the Quasi-Linear Parameter Varying (Quasi-LPV) representation. In this method, instead of the nonlinear state difference equations of the system, a sequence of linearized state equations about a nominal state-control history, over the prediction horizon, is used. By so doing, standard Quadratic Programming (QP) optimization algorithms could be used for the online optimization problem, therefore, speed and efficiency of convergence to the optimal solution would be enhanced. Efficacy of this method is shown by simulation study of

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	a 2-DOF robot manipulator.
TF1-090	Study of MIMO Control Laws for Seismic Isolation of Flexible Payload **Jennifer Watchi**, Binlei Ding, Guoying Zhao and Christophe Collette Université Libre de Bruxelles Brussels, Belgium **Abstract**—In order to operate properly, some precision applications need to be isolated from the ground motion in the six degrees of freedom. This paper presents the model of a hexagonal payload which is isolated in all directions. The model is validated by comparison with experimental data. It reproduces properly the suspension modes and the flexibilities of the structure. Two multi-input multi-output (MIMO) control techniques have been applied to this system: centralized control and singular value decomposition (SVD). Both methods allow to reduce by a factor 100 the transmission of ground motion at low frequency (up to 5 Hz) without interfering with the flexible modes.
TF1-039	Fractional Order Design of a Digital Controller for a High-Speed Electromagnetic Actuator **Patrick Lanusse**, Massinissa Tari, Zlatina Dimitrova and François Aioun University of Bordeaux, France **Abstract**—This paper presents the design of a fractional order based controller for a high-speed electromagnetic actuator developed for a camless engine valvetrain. For rapid prototyping and flexibility, the controller is digital and it is particularly shown that it can be designed while taking into account all sampling issues even if a high closed-loop bandwidth is required. Simulations and experimental results shows that the design of the innovative actuator and of its controller provides very good dynamic performance.
TF1-077	A Multi-robot Control System based on ROS for Exploring Disaster Environment **Kyon-Mo Yang**, Jong-Boo Han and Kap-Ho Seo Korea Institute of Robotics and Technology Convergence, South Korea **Abstract**—This control system is implemented to coordinate multiple robots in cooperative exploration tasks, in which a task assignment algorithm is used for calculating the expectation cost to achieve the required tasks and then allocate necessary tasks to specific robots. Robot control systems are used to gather crucial information about a disaster environment, such as a victim's position or changes in an indoor environment before a human is able to enter that environment. There are practical problems in using previous systems because these systems need professionals to operate these multi-robots. The proposed system automatically distributes tasks to each robot based on target positions that are selected by the person who does not possess any prior knowledge about robot operation. Therefore, the operator needs only to determine the target position of interest and not be concerned about controlling the robot. Moreover, the system is implemented using ROS in order to add functions and apply this system to various types of robots. This system has been verified and evaluated by Turtlebot 3 in the Gazebo simulator, as

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	well as in a real setting by conducting the system usability scale (SUS) with 23 firefighters.
TF1-078	On the Shaking Force Balancing of Compliant Mechanisms S. Martínez, J. P. Meijaard, and **V. van der Wijk** Delft University of Technology, Netherlands **Abstract**—This paper is a first approach in finding design principles for the design of shaking force balanced compliant mechanisms. Shaking force balance means that the motions of the mechanism do not create any resultant dynamic reaction forces on the base, eliminating base vibrations. It is found that for a single balanced rotatable flexible link two stiffness related balance conditions exist in addition to the balance condition known for a rigid link. With these conditions the shaking force balance of a planar parallelogram mechanism with flexible links is considered. The case with fully compliant hinges is applied to a planar translator and the results are compared with the case in which the hinges are real revolute joints. Simulations show perfect force balance for the model with revolute joints and a reduced shaking force of 67 % for the model with flexible joints. Prototypes of both mechanisms were developed and experimentally tested, showing shaking force reductions of 93 % and 97.5 %, respectively.
TF1-108	An Interactive Lane Change Decision Making Model With Deep Reinforcement Learning **Shenghao Jiang**, Jiying Chen and Macheng Shen Harvard University, United States **Abstract**—By considering lane change maneuver as primarily a Partial Observed Markov Decision Process (POMDP) and motion planning problem, this paper presents an interactive model with a Recurrent Neural Network (RNN) approach to determine the adversarial or cooperative intention probability of following vehicle in target lane. To make proper and efficient lane change decision, Deep Q-value network (DQN) is applied to solve POMDP with expected global maximum reward. Then quintic polynomials-based motion planning algorithm is used to obtain both optimal lateral and longitudinal trajectory for autonomous vehicle to pursuit. Experimental results demonstrate the capability of the proposed model to execute lane change maneuver with comfortable and safety reference trajectory at an appropriate time instance and traffic gap in various highway traffic scenarios.
TF1-009	Optimal Fractional Order PID Controller Design for Fractional Order Systems by Stochastic Multi Parameter Divergence Optimization Method with Different Random Distribution Functions **Abdullah Ates**, Baris Baykant Alagoz, Yangquan Chen, Celaleddin Yeroglu and S.Hassan Hosseinnia Inonu University, Turkey **Abstract**—This paper modifies Stochastic Multi Parameter Divergence Optimization Method (SMDO) by using some types of random distribution functions in order to

	our approach using low-cost-optic-sensors, placed on an omni wheeled platform and show the positioning accuracy.
TF1-127	Design of Exoskeleton for Paraplegics Walking – Humanoid Robotics Approach Velayudham Ganesan, Edward Y.L. Gu Oakland University, United States of America **Abstract**—Paraplegics are a type of Spinal Cord Injury (SCI) disabled persons who need walking support for day-to-day mobility. Stability is a major concern while designing walking support systems. This research is an attempt to design an Exoskeleton with necessary walking stability based on humanoid bipedal robot. A parallel-serial chain of 25 joint axes legs-only exoskeleton named Lower Extremity Exoskeleton Robot (LEE Robot) is modeled and simulated for walking stability using posture adjustment and the law of balance techniques. It includes PD controllers for posture adjustment and walking balance. Zero Moment Point (ZMP) technique is implemented in the simulation to test the Exoskeleton walking stability.
TF1-128	Design and Development of a Low-Cost High-G Centrifuge System (Cyclone) **Navid Mohajer**, Zoran Najdovski, and Saeid Nahavandi Deakin University, Australia **Abstract**—High-G Centrifuge Systems provide a safe and controllable environment for G motion fields required for fighters' pilots training. Lacking an operational Human Centrifuge System in Australia, the Institute for Intelligent Systems Research and Innovation (IISRI) at Deakin University has designed and built a low-cost High-G Centrifuge System, named Cyclone. Cyclone has the capability of generating a maximum sustained acceleration of 9G with an onset rate of 5G/sec. The system has an effective arm length of over 5m, which is actuated by a capable gear-motor. This paper addresses the main characteristics of Cyclone including modular design, self-balanced structure and rotating main drive. Moreover, the design and development of the system are discussed and the experimental results of two test scenarios will be presented. The developed system offers the highest level of operational and occupational safety to be rated as a human-capable system. The human-rating of Cyclone is currently investigated.
TF1-061	Adaptive eXogenous Kalman Filter for Actuator Fault Diagnosis in Robotics and Autonomous Systems **Agus Hasan** and Tor Arne Johansen University of Southern Denmark, Denmark **Abstract**—This paper presents an algorithm for actuator fault diagnosis in robotics and autonomous systems under random uncertainties based on a cascade of nonlinear observer and linearized Kalman filter. The two-stage estimation method assumes uniform complete observability and controllability conditions and persistent excitation condition. To this end, we consider dynamical systems of robotics and autonomous sys-tems with one-sided Lipschitz nonlinearity. To demonstrate the effectiveness of the proposed algorithm, numerical simulations in a single-link

	flexible joint robot are performed.
TF1-1001	Task Scheduling For Human-Robot Collaboration With Uncertain Duration Of Tasks: A Fuzzy Approach Andrea Casalino, **Eleonora Mazzocca**, Maria Grazia Di Giorgio, Andrea Maria Zanchettin1 and Paolo Rocco Politecnico di Milano, Italy **Abstract**—Collaborative robotics is a new production paradigm for manufacturing systems. Typical applications are collaborative assemblies, requiring humans and robots to share a common space to accomplish common tasks. This imposes to predict the actions of humans and consequently control the robot in a safe way, making the time required for completing a task non deterministic as the robot could be forced to be slowed down in unpredictable ways. Moreover, the uncontrollable nature of the human mate as well as the intrinsic variability of humans comple-tion times introduce other sources of uncertainty to account for. This work aims at proposing a novel fuzzy scheduling approach for managing in an optimal way the uncertainties arising in collaborative assemblies. Realistic experiments, involving the assembly of two products, are performed using the dual arm robot YUMI of ABB.
TF1-113	Detecting the Distribution of a Robotic Swarm in Uncertain Conditions Eliashiv Cohen, Yakov Idelson, Oded medina and Nir Shvalb **Presenter: Shlomi Hacohen** Ariel University, Israel **Abstract**—Localization problem of a swarm is required for most tasks related to swarms. In many cases real world sensors possess inherent measurement error. Nevertheless, having a large set of inter-measurements may compensate for this. The paper implements Extended Kalman Filter to estimate the swarm's distribution. Indeed, a set of simulated experiments demonstrate the algorithm robustness and simplicity. Finally, we show that the resulting error estimation is reliable.
TF1-037	A Fractional Model Of The Friction-Temperature Behavior In Robot Joints Roberto Pagani, **Fabrizio Padula**, Giovanni Legnani, Ryan Loxton, and Antonio Visioli Curtin University, Australia **Abstract**—It is well-known that friction changes with the temperature in robotic joints, and the temperature depends on the action being performed. In this paper we present a fractional model that describes the relationship between power generation/loss and temperature in the joints of industrial robots. The proposed mathematical model is used to predict friction variation during the robot working cycle without using temperature sensors. Several experimental tests have been per-formed on a commercial 6 degree-of-freedom anthropomorphic manipulator. Results confirm that the proposed model is able to estimate the behavior of the friction in the joints during robot working cycles. This can be used to compensate for friction, thus improving the control performance, and to predict energy consumption.
TF1-106-A	Force Control of an Anthropomorphic Robotic Hand with Soft Tactile Sensors

Session 3

Daiki Matsuoka and Goro Obinata

Chubu University Graduate School of Engineering, Japan

Abstract—This report describes the design and implementation of tactile sensors into an anthropomorphic robot hand. The sensor consists of a soft touch-pad, a LED floodlight and a CMOS camera. A new design of the sensor aims to reduce the size for setting in fingertips of an anthropomorphic robot hand. It is well known that humans use visual and haptic information in the programming of the grip forces for lifting objects of unknown weight. Tactile sense helps to define the final grip force by detecting the object weight and the slipperiness of the surface. The paper proposes simple control scheme for determining the grip force by the information of the tactile sensor.

The designed anthropomorphic index finger consists of finger frames, three rotary joints, one tactile sensor, one flexion sensor and one linear actuator. The design thumb has the similar components as the index finger except that it has two rotary joints. The tactile sensor is set at the fingertip. It consists of CMOS camera, LED floodlight and a touch-pad, and it is able to measure the applied normal force. The flexion sensor which is also set in the finger is to measure the bending of finger. The linear actuator (PQ12, Firgelli Tech.) is to flex and extend the finger with wires.

TF1-1003-A	Obtain And Compare Static And Dynamic Stiffness Map For The Flexible Redundant Manipulator **Hamid Bamshad**, Hyemi Jeong and Hyunseok Yang Yonsei University, South Korea **Abstract**—in recent years, without doubt, there are more demands in industry for the manipulators to accomplish jobs that require higher force and torque, especially in the case of dangerous task like cutting or machining. Moreover, while, redundant manipulators give more posture options to the operator to choose the best configuration based on the task and robot properties, redundancy in manipulator can increase the complexity of computation process and time. One of the main concerns of using serial manipulator for the high force, high precision task is end-effector accuracy. In reality, by applying the external force to the end-effector, manipulator's parts are subjected to the deformation and the amount of deformation highly depends on the part's stiffness. There are different methods to identify and compensate this end-effector errors caused by stiffness. This paper proposes stiffness index which presents the error value based on robot configuration. Consequently, it is possible to find the stiffness map for redundant manipulator by plotting the stiffness index with respect to all of the possible postures for specific end-effector pos. For the application such as milling or drilling or cutting associate with external dynamic force. This paper obtained stiffness index in two different ways based on static and dynamic models. These models are verified by simulation in ADAMS. Finally two type of stiffness maps are created and compared to each other. Based on the assumptions, results show that under certain circumstance, static map is accurate enough to be implemented in posture decision control algorithm to find

	the best posture with the lowest amount of end-effector error. In this case the computation time will be reduced significantly which make it suitable solution for the online control systems.

Session 4

November 8, 2019
[Author Presentation 4]

🕘 9:50-12:20

📍 Mekelrooms 2

Chaired by Nima Karbasizadeh Esfahani

17 Presentations—

TF1-067,TF1-119,TF1-100,TF1-129,TF1-034,TF1-023,TF1-085,TF1-063,TF1-111,TF1-041,TF1-017,TF1-099,TF1-064,TF1-114,TF1-025,TF1-126,TF1-092-A

TF1-067	Design Principles for Improved Mechanical Reliability of Cantilever Piezoelectric Vibration Energy Harvesters J.A.Brans, **T.W.A.Blad** and N.Tolou Delft university of Technology, Netherlands **Abstract**—Vibration energy harvesters based on piezoceramics can provide a sustainable source of energy for low-power electronics. The greatest issue preventing these systems from being widely used is their poor reliability. With the aim to maximise their power output, the devices are often operated close the point of yielding, which results in microcracks and fatigue in the piezoceramic layer. This paper offers a comparative review of design principles that aim to improve the reliability of piezoelectric vibration energy harvesters. Three different design principles are investigated with the focus on strain limitation. The results show that strain homogenisation, strain limitation and compressive strains can be effective design principles to increase reliability without sacrificing efficiency.
TF1-119	An Image-Based Path Planing Approach For A Two Arm Cooperative Robot **Cosmin Copot**, Marco Marchesi and Antonio Visioli University of Antwerp, Belgium

Abstract—In this paper an image-based path planning ap-proach for a dual arm robot is presented. The main idea introduced here is to develop an algorithm which is able to calculate a goal-path for the robot using visual features extracted from an image. The role of the proposed methodology is to improve the degree of automation of a robotic system and the programmability of the control code and thus to enable a 'free' planing phase. In order to implement and evaluate the designed strategy an ABB YuMi robot was considered. Multiple experiments were performed and the results obtained in this study show a satisfactory performance. Using the proposed algorithm it requires only few minutes to an operator (non expert in robot programming) to plan a complex robot trajectory for independent or synchronized motion.

TF1-100	A Search Strategy for Motion Planning of Unmanned Crawler Crane Yuanshan Lin, **Fuben He**, Xinzhong Cui, Fang Wang and Hong Yu Dalian University of Technology, China **Abstract**—The motion planning for unmanned crawler crane (UCC) whose initial and goal described accurately in workspace was challenging. The difficulty dues to the fact that the initial and goal produce low-dimensional self-motion manifolds, which rendered the search of planners bypassing the self-motion manifolds. In this study, a new concept of the neighbor-hoods of self-motion manifold was introduced, and the corresponding search strategy of bias was developed towards extending the nodes within the neighborhoods of self-motion manifolds so as to decrease the probability of the tree nodes walking by the self-motion manifolds. Then this strategy was used to improve the performance of BiMRRTs proposed in the previous study. Finally, several simulation experiments were implemented to demonstrate the effectiveness of the proposed search strategy of the neighborhood of self-motion manifold. The results showed that the proposed search strategy was able to dramatically decrease the planning time and the path length simultaneously.
TF1-129	NMPC-based Controller for Autonomous Vehicles Considering Handling Performance Mohammad Rokonuzzaman, **Navid Mohajer** and Saeid Nahavandi Deakin University, Australia **Abstract**—Autonomous Vehicles (AVs) have shown an evolu-tionary impact on the transportation systems by providing several benefits in terms of active safety as well as saving travel cost and time. The growing market of the AVs reflects the fact that different aspects of the AVs are still improving to provide a more comfortable and safer environment for the passengers. One of the subsystems which has potential to be improved is the path tracking controller. This subsystem is mainly responsible for the accurate and safe implementation of the trajectories. In this study, a nonlinear path tracking controller is proposed to improve the handling behavior of the AV. To this aim, a Nonlinear Model Predictive Controller (NMPC) is developed to optimise the tracking error and the handling behaviour of the AV. The constrained optimisation problem is solved using a nonlinear programming approach. The

	outcomes of the study show that adoption of this technique can result in improvement of handling behaviour and passengers comfort while meeting the requirement of an accurate path tracking.
TF1-034	Variable Stiffness and Damping Impedance Control with Disturbance Observer **Zhiqiang Ma** and Gangqi Dong Northwestern Polytechnical University, China **Abstract**—This paper proposes a variable stiffness and damping impedance controller with a new closed-loop impedance architecture containing the negative power type stiffness and damping parameters. The sliding mode control technique is employed to construct an asymptotically stable reduced order system using PID sliding surface. The external disturbance is well considered, which easily propagate to the preset impedance architecture to degenerate the impedance performance. To address this problem, a disturbance observer is introduced into the control system to reduce the adverse effect by partially eliminating the disturbance. The proposed impedance architecture owns better transient performance compared with the trivial spring-damper impedance architecture, which is well illustrated by numerical results.
TF1-023	Robot Dynamics with URDF & CasADi **Lill Maria Gjerde Johannessen**, Mathias Hauan Arbo and Jan Tommy Gravdahl Norwegian University of Science and Technology, Norway **Abstract**—Fast, accurate evaluation of the dynamic param-eters is a key ingredient for accurate control, estimation, and simulation of robots. As these are time-consuming to compute by hand, a software library for generating the rigid body dynamics symbolically can be of great use for robotics researchers. In this paper, we propose a library to efficiently compute and evaluate robot dynamics and its derivatives. Based on a URDF description of the robot's kinematics, three major rigid body dynamics algorithms are used to retrieve the dy-namics symbolically in the CasADi framework. To validate the numerical accuracy, the numerical evaluation of the solutions are compared against three other well-established rigid body dynamics libraries, namely RBDL, KDL and, PyBullet. We conduct a timing comparison between the libraries, and we show that the evaluation times of the symbolic expressions are at most one order of magnitude higher than the numerical evaluation times. Last, it is shown that the evaluation times of the dynamics derivatives remain of the same order as the evaluation times of the dynamics expressions.
TF1-085	Quadrotor Trajectory Tracking Control using Non-Linear Model Predictive Control with ROS Implementation **Mohamed Owis**, Seif El-Bouhy and Ayman El-Badawy German University in Cairo, Egypt **Abstract**—This paper presents a Model Predictive Controller for trajectory tracking control of the quadrotor using the ACADO Toolkit on Matlab/Simulink. Model Predictive Control (MPC) prediction feature and ability to obtain optimal control action yields an accurate trajectory tracking performance. The controller is applied to

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	a quadrotor system. The math-ematical model was derived using Newton's and Euler's laws. Simulations for the trajectory tracking test was done for evaluating the trajectory tracking performance. Afterwards, an interface between RotorS Gazebo Simulator and Simulink was implemented using the Robot Operating System (ROS) for validation of the controller's performance. The paper presents the results of both simulations under disturbances to determine the suitability and validity of the proposed control algorithm.
TF1-063	Identification of Dynamic Systems With Position Dependent Load Parameters **Foeke Vanbecelaere**, Jos Knockaert, Kurt Stockman, Michael Monte Ghent University, Belgium **Abstract**—Cascaded control is still the most common and convenient structure in standard commercial drives. The most convenient tuning method is to apply calculation rules on an offline identified frequency response of the open-loop system. Obviously, this standard approach is only valid for linear time-invariant systems. However, the mechanical dynamics of modern machines very often depend on the angular position of the driven axis. Consequently, the system is time-variant and linearisation is needed to obtain an open-loop frequency response. In this paper, a system identification approach based on this linearisation is presented for dynamic systems with variable load torque and variable load inertia. The feasibility of this approach is validated with measurements on an industrial case.
TF1-111	Path Planning for Multiple Mobile Robots in Smart Warehouse **Ali Bolu** and Ömer Korçak Marmara University, Turkey **Abstract**—Warehouse operations need high labor force and physical space. Currently, companies with huge warehouses are investing on autonomous robots to save time and energy, and to prevent human-based errors. One of the most important challenges in a smart warehouse with multiple moving robots is path planning because of its dynamics. This paper provides a complete and error-free solution to the path-planning problem, and describes its performance in various warehouse scenarios with different number of robots and different design considerations.
TF1-041	Discrete Open Buslaev Chain with Heterogenous Loading **Marina Yashina** and Alexander Tatashev Moscow Automobile and Road Construction State Technical University, Russian **Abstract**—We consider a dynamical system called a discrete open chain of circumferences. There is a cluster of particles in each circumference. The clusters move in accordance with given rules. The length of circumfer-ences is the same, and the lengths of clusters are differ-ent. There are common points of neighboring circum-ferences. These common points are called nodes. This dynamical system belongs to the class of Buslaev type networks. We study the system behavior. We have ob-tained results regarding the main characteristic — the spectrum of the

	average clusters velocities depending on clusters lengths distribution.
TF1-017	Experimental Evaluation of Computation Cost of FastSLAM Algorithm for Unmanned Ground Vehicles Ahmed Al-Tarras, **Mostafa Yacoub,** Mostafa Asfoor and Al-Hussein Sharaf Military Technical College, Egypt **Abstract**—Two decades ago, FastSLAM algorithm for mobile robots was introduced. Since then, dozens of research work focused on FastSLAM algorithm performance enhancement while keeping reduced computation cost. Since experimental evaluation of computation cost is dependent on the hardware capabilities of the platform, the present work introduces a quantitative theoretical method for predicting the computation cost of the FastSLAM algorithm. The method relies on the big (O) computation complexity which represents the worst case. The method was evaluated experimentally with different number of particles and different number of map features. The computation cost evaluation analysis was broken down into prediction, observation, data association and resampling computation cost evaluation. The proposed method was proven to be helpful in customization of FastSLAM parameters like number of particles and data association optimization for FastSLAM algorithm developers.
TF1-099	A Robust Calibration Method For The Underwater Transponder Position Based On Gauss-Newton Iteration Algorithm **Liang Zhang** and Tao Zhang Southeast University, China **Abstract**—The ultra-short baseline(USBL) is widely used in ships and underwater navigation and positioning. An accurate transponder position is critical for the ultra-short baseline positioning systems. However, in a complex underwater environment, the performance of the traditional calibration method is poor in the presence of outliers. Thus, a robust Gauss-Newton iteration algorithm is proposed for the calibration of the transponder position by the paper. The outliers can be detected by the improved Badar data snooping. The simulation and field experiment verified that the calibration accuracy of the transponder position is higher with the proposed method in the presence of outliers. Because of the more accurate transponder position, the positioning accuracy of the USBL can be further improved compared to the traditional methods.
TF1-064	Design of a Robotic Bicopter **Özge Beyza Albayrak**, Yağmur Ersan, Ayşen Süheyla Bağbaşı, Ahmet Turgut Başaranoğlu and Kutluk Bilge Arıkan TED University, Turkey **Abstract**—This article presents a Bicopter type of a flying robot with two rotary-wing units which are placed in a tandem form on the chassis. The rotors are tilted by the aid of the tilt mechanism. Cascaded type of PID controllers are designed on the dynamical models for the attitude and altitude dynamics. The simulated control

	systems are implemented and tuned on the Naze32 flight controller which is connected to a Raspberry Pi single board computer for real-time applications. The real-time performance is monitored and evaluated during the tests and it is seen that the system is suitable for indoor type of robotic applications.
TF1-114	Complementary Filters Shaping Using H-Infinity Synthesis **Dehaeze Thomas**, Vermat Mohit and Collette Christophe University of Liege, Belgium **Abstract**—For many applications, large bandwidth and dy-namic ranges are requiring to use several sensors, whose signals are combined using complementary filters. This paper presents a method for designing these complementary filters using H∞ synthesis that allows to shape the filter norms. This method is shown to be easily applicable for the synthesis of complex complementary filters.
TF1-025	Assessing The Performance of Multiple Control Techniques for Position Tracking of a Multi-section Continuum Robot Osama Moussa, Mai Mira, **Ahmed Fahmy**, Omar Shehata and Elsayed Morgan German University in Cairo, Egypt **Abstract**—This paper presents a study on miniature continuum robots which can bend continuously along their length and can be constructed to be more than one section to increase their degrees of freedom. This study is concerned with providing the kinematics and the dynamics of the robot. The kinematic equations is provided by Piece-wise constant curvature (PCC) assumption which is based on curve geometry. The Dynamics of the robot are provided by the analysis of the Lagrangian equation. Next, three control strategies are applied on a two-section continuum robot model using MATLAB Simulink environment to demonstrate the effectiveness of each control loop. The three control strategies are Proportional Derivative (PD) control, Fuzzy Logic Control (FLC), and Sliding Mode Control (SMC). The simulation results show an advantage in performance for the intelligent controller (FLC) and the nonlinear robust control (SMC) over the PD control.
TF1-126	Applications of Artificial Intelligence in Vehicular Networks: Review **Dharmik Donga** and Santosh Kumar Bharti Pandit Deendayal Petroleum University, India **Abstract**—It was the year 1952 when we saw the first breakthrough in artificial intelligence when Arthur Samuel developed a checkers playing computer. Since then, the advancement of artificial intelligence has been significant. From employing neural networks to play chess to detecting cancer using artificial intelligence, the advancement is indeed a quantum leap. The emerging application of artificial intelligence is in vehicular networks. This review paper discusses the various challenges in vehicular networks and how artificial intelligence can be used to overcome these challenges. The paper also outlines how artificial intelligence can assist vehicular networks to increase efficiency.
TF1-092-A	Coupled Macro-Micro Robot Systems for 3D Printing of Cement

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Ian D. Walker

Clemson University, USA

Abstract—We will describe new research in the development of an innovative cement deployment robot system. The system is based on a novel cable-driven macro-micro design: a cable-robot to act as the macro-base, and a cable-driven continuum robot (integrated with concrete delivery hose) as the micro unit. Such a mechanical-design architecture is field-deployable while supporting a large workspace/load carrying capability. The micro system represents a new form of compliant continuum robot. In operation, the system needs to be capable of smooth and accurate low-level motion/force control; recognize and respond to high-level human-user force/visual cues; following them as necessary, but also taking the initiative and lead when appropriate. This represents an interesting challenge in modeling and control of dynamically coupled flexible robot systems

Session 5

November 8, 2019
[Author Presentation 5]

🕐 **13:30-16:00**

📍 **Mekelrooms 2**

Chaired by Rafiq Ahmad

16 Presentations—

TF1-021, TF1-029,TF1-120,TF1-086,TF1-004,TF1-047,TF1-028,TF1-065,TF1-043,TF1-050,

TF1-026,TF1-060,TF1-072,TF1-031,TF1-053,TF1-098

TF1-021	Trajectory Tracking Control of a Mobile Robot with Model Predictive Controller and Observer **Can Ulas Dogruer** Hacettepe University, Turkey **Abstract**—This paper proposes the use of a model predictive controller with state observer to solve the trajectory tracking and kinematic model identification problem in mobile robotics field. Since it can be shown that observer and model predictive controller dynamics are independent from each other; model predictive controller based on a local linear-time-invariant model is designed by minimizing a finite horizon quadratic cost function and observer dynamics is designed by using a pole-placement technique. Performance of the proposed model predictive controller and observer pair was compared against that of a regular model predictive controller and it has been shown that the proposed controller-observer pair has better trajectory tracking performance.
TF1-029	Experimental Characterisation of Hydraulic Fiber-Reinforced Soft Actuators for Worm-Like Robots **Matheus S. Xavier**, Andrew Fleming and Yuen Yong University of Newcastle, Australia

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	Abstract—This article describes the design and fabrica-tion of fiber-reinforced soft actuators for a worm-like robot designed to operate inside constrained tubes. The actuators include bending, extension and torsion. These actuators are experimentally characterised by measuring the deflection versus applied pressure. The results demonstrate that fiber wrapping pattern, geometry of cross-section and elastomer selection are the main determinants of performance. The actuators under consideration are employed to construct a soft worm-like robot capable of ascending a pipe. This class of applications includes steerable catheters, endoscopes and pipe inspection devices.
TF1-120	Soft Jamming Gripper with the External Prominence of Membrane for Human-Robot Cooperation **Rasool Shahsevani**, Sebastian Reitelshöfer, Reza Alimardani and Jörg Frank Friedrich-Alexander University of Erlangen-Nuremberg, Germany **Abstract**—Designing grippers as robotic hands is one of the largest challenges in robotics. The process of gripping and moving is achieved in different ways through various models of robotic grippers. Dexterous, careful and useful robotic gripper not necessarily need to be a claw or an artificial hand with several fingers. A promising technical alternative is the so-called jamming gripper, which is made of a flexible membrane filled with appropriate powder, e.g. ground coffee, as an assistive device to join in robots. The purpose of the work described in this paper is to develop a robotic gripper with an advanced surface structure with external prominence to enhance the smooth exterior of the membrane. Tests are performed to determine the influence of the different objects and friction force of the membrane on the gripping performance and holding force of the gripper system. The results show that by improving the outer surface geometry of the membrane, friction is increased under the same condition, e.g. vacuum and pressure, so that heavier objects can be lifted. In particular, the holding force of the uneven surface membrane (USM) is much higher than the smooth surface membrane (SSM) to grip the various objects.
TF1-086	Microcontroller Based Acoustic Signal Processing Shahid Aziz, Haris Naeem, **Muwahida Liaquat,** Asim Ismail and Aqib Pervaiz National university of sciences and technology, Pakistan **Abstract**—This paper aim to propose an alternative, cost efficient and innovative method for the processing of underwater acoustic signals. The proposed solution is based purely on a single microcontroller instead of data acquisition cards to carry out all the operations of the depth sounding system including the processing of the acoustic signal. This approach is more mature, cost efficient, reliable, and accurate requiring less space footprint than the other available methods.
TF1-004	Observer Design for Boundary Coupled Fractional Order Distributed Parameter Systems Yanjiu Zhou, **Juan Chen** and Baotong Cui Tallinn University of Technology, Estonia

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	Abstract—This paper studies the observer design for the fractional order boundary coupled distributed parameter systems. Firstly, we obtain the decoupled observer error systems from the state system and observer system. Secondly, the advection terms are eliminated through the invertible transformation and we can obtain the general reaction-diffusion partial differential equations, which are more convenient for discussions. Thirdly, Backstepping method and target systems are employed to give kernel partial differential equations and then the related observer gains can be derived from the corresponding kernels. Finally, Mittag-Leffler stability of the designed fractional order observers is analyzed and the main results are illustrated by the simulation graphically.
TF1-047	Design and Modelling of a Compact Variable Stiffness Mechanism for Wearable Elbow Exoskeletons **Zhongyi Li** and Shaoping Bai Aalborg University, Denmark **Abstract**—This paper presents a compact variable stiffness mechanism (VSM) with reconfigurability. The VSM is able to achieve variable stiffness in adjustable ranges, due to its reconfigurable design. The new VSM features with a compact and light weight structure, and can be used as a stand alone module, or integrated in wearable elbow exoskeletons and other transmissions. In the paper, mechanics models are developed for VSM to reveal the stiffness performance and torque-deflection characteristics. A prototype of VSM is constructed and static testing results validate the models. The proposed VSM is finally integrated in a wearable elbow exoskeleton.
TF1-028	Design Optimization of Pneumatically actuated three jaw Gripper using Genetic Algorithm **Saravanakumar D,** Manoj Srivatsn S, Sakthivel G and Muthuramalingam T Vellore Institute of Technology, Chennai Campus, India **Abstract**—Design optimization of grippers should be decisive for felicitous applications, definitive results, and for the implementation to be efficacious. This paper concentrates on mathematical modelling of a three-jaw gripper, to procure the fundamental design parameters that are crucial for design constraints. Multi-objective design optimization formulation is adapted to calibrate multi-constraint design variables, to optimally obtain the dimensions of the links and dimensions of the actuating cylinder. The Gripper is analyzed for dynamic modelling, to compute gripping-force and gripping-width with precision. Compromised solution based on objective function formulation is applied, where the population is generated with genetic algorithm. This would deduce the optimal solution set among the generated population and the control variables are regulated by establishing a relation between decision variables and objective functions, such that we acquire better gripper ratio, gripper force analysis as wells design sensitivity analysis.
TF1-065	Identification in the frequency domain of mechanically coupled axes on servo-screw presses **Henry Kirchner**, Johannes Quellmalz, Peter Müller and Holger Schlegel

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	Technische Universität Chemnitz Saxony, Germany **Abstract**—The article deals with the system identification of drive trains on forming machines. The aim is to analyze the mechanical properties in the frequency domain. A comparison of uncoupled single axes with several axes in a coupling system should provide information on whether different controller parameters or controller structures have to be adapted for both cases. This will be investigated using the example of an electromechanical die cushion on a servo screw press.
TF1-043	Mango Sorting Mechanical System Combines Image Processing Nguyen Truong Thinh, Nguyen Duc Thong, Huynh Thanh Cong and Nguyen Tran Thanh Phong Dong Thap University, Viet Nam **Abstract**—Sorting and Classification of mango, there are different colors, weights, sizes, shapes and densities. Currently, classification based on the above features is being carried out mainly by manuals due to farmers' awareness of low accuracy, high costs, health effects and high costs, costly economically inferior. The internal quality of the mango such as sweetness, hardness, age, brittleness... is very important but is only estimated by external or human-perceived evaluation. Therefore, it is necessary to use artificial neural networks to solve this problem. This study was conducted on three main commercial mango species of Vietnam to find out the method of classification of mango with the best quality and accuracy. World studies of mango classification according to color, size, volume and almost done in the laboratory but not yet applied in practice. The quality assessment of mango fruit has not been resolved. Application of image processing technology, computer vision combined with artificial intelligence in the problem of mango classification or poor quality. The goal of the study is to create a system that can classify mangoes in terms of color, volume, size, shape and fruit density. The classification system using image processing incorporates artificial intelligence including the use of CCD cameras, C language programming, computer vision and artificial neural networks. The system uses the captured mango image, processing the split layer to determine the mass, volume and defect on the mango fruit surface. Especially, determine the density of mangoes related to its maturity and sweetness and determine the percentage of mango defects to determine the quality of mangoes for export and domestic or recycled mangoes.
TF1-050	An Error Correction Approach based on AR model and RLS for Intertial Navigation System **Di Wang**, Xiaosu Xu and Yongyun Zhu Southeast University, China **Abstract**—In order to reduce the influence of fiber optic gyroscope (FOG) random drift error on inertial navigation systems (INS), an error correction approach based on auto regressive (AR) model and recursive least squares (RLS) is put forward in this paper. First, based on real-time observations at each restart of the gyroscope, the

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	model of FOG random drift can be established online. In the improved AR model, the FOG measured signal is employed instead of the zero mean signals. Then, a modified recursive least square is introduced, which can quickly estimate the model parameters before using Kalman filter to real-time filtering. Finally, FOG signal under different motion conditions are employed to validate the effectiveness of the proposed approach. The analysis results show that proposed approach can reduce the random drift error of FOG effectively. In addition, Navigation accuracy can be increased by 32% when inertial navigation lasts for 500s.
TF1-026	Vive for Robotics: Rapid Robot Cell Calibration **Morten Astad**, Mathias Arbo, Esten Grøtli and Tommy Gravdahl Norwegian University of Science and Technology, Norway **Abstract**—The use of an HTC Vive; a virtual reality (VR) system and its innovative tracking technology is explored in order to create an approximate one-to-one mapping to the virtual representation of a robot cell. The mapping is found by performing hand-eye calibration, establishing a spatial relationship between the inertial frames of the robot cell and the tracking system. One of the main contributions of this article is the development of an open-source robotic operating system (ROS) package for VR devices such as the HTC Vive. The package includes automated calibration procedures such that the devices gives a centimetric measurement error in the robot cell. The calibrated system has problems that are related to specific issues of the tracking technology. This article outlines these issues, their cause, and potential fixes in a concise manner. A simple assembly scenario is presented, where the outline of objects in the robot cell are defined by registering points with the HTC Vive tracker. The potential use cases of the calibrated system are limited by its accuracy, and depends on the required tolerances.
TF1-060	Comparison of Linear and Nonlinear MPC on Operator-In-the-Loop Overhead Cranes **Marco Giacomelli**, Davide Colombo, Marco Faroni, Olivier Schmidt, Luca Simoni and Antonio Visioli University of Brescia, Italy **Abstract**—Model Predictive Control has been proved to enhance the control performance of overhead cranes. However, in Operator-In-the-Loop (OIL) overhead cranes the trajectory of the payload strongly depends on the runtime decisions of the user and can not be predicted beforehand. Simple assumptions on the future references evolution have therefore to be made. In this paper we investigate the applicability of linear and nonlinear MPC strategies to the case of OIL overhead cranes, based on different assumptions on the future evolution of the length of the hoisting cable.
TF1-072	Flushing Pressure Automation For Efficient Machining in EDM Process **Muthuramalingam T**, Ganeshbabu L, Vasanth S, Karthikeyan P and Saravanakumar D SRM Institute of Science and Technology, India **Abstract**—Electrical discharge machining (EDM) is important unconventional

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	machining process in which utilizes electrical spark energy to remove the material from the workpiece. In such process, the workpiece and tool electrode has to be separated with the constant air gap throughput the machining process for producing the discharge energy. In the present study, an endeavor has been made to automate the flushing mechanism for enhance the machinability by monitoring the gap voltage in EDM process. It has been observed that the proposed approach can reduce the unwanted arcing effect in a considerable way.
TF1-031	P(VDF-TrFE-CTFE) Actuators with Inkjet Printed Electrodes K. Keith Baelz and **Andres Hunt** Delft university of Technology, Netherlands **Abstract**— Piezoelectric inkjet printing has proven its po-tential for use as an additive manufacturing technique for depositing thin films, and can be especially useful in the rapid prototyping of devices such as printed circuit boards (PCB), energy harvesters, capacitative sensors, or radio-frequency identification (RFID) antennae. The increasing availability of conductive inkjet inks of various compositions offer the means to print conductive patterns with relative ease in very lit-tle time. Whilst conductive inks are typically used to print conductive circuitry, the possibility of printing more modern and better performing smart materials opens the path for fully inkjet printed active devices. This offers the potential to manufacture smart materials and actuators faster, more economically, and with better repeatability than when using masking or photolithographic processes, without requiring specialized machinery or facilities. In this paper, we employ a low cost approach to manufacture 4 layer relaxor ferroelectric cantilever actuators using a commercial inkjet printer. A carbon black nanoparticle dispersion is printed onto an absorbent substrate to form a conductive bottom electrode, before a layer of P(VDF-TrFE-CTFE) is applied on top as the active material. Finally an additional layer of carbon black is printed on top of the polymer to form the top electrode. The finished actuators are poled to induce piezoelectric behavior in addition to the existing electrostrictive behavior. The resultant actuators can achieve deflections of up to 206 μm under loads of 300 V, and can achieve over 3 mm deflection when operating at resonance frequencies of 110-130 Hz.
TF1-053	Linear Programming Under P-Box Uncertainty Model **Keivan Shariatmadar** and Mark Versteyhe Katholieke Universiteit Leuven,Belgium **Abstract**—This paper considers a constrained optimisation problem under uncertainty with at least one element modelled as a probability box uncertainty. The uncertainty is expressed in the coefficient matrices of constraints and/or coefficients of goal function. In our previous work, such problems were studied under interval, fuzzy sets, and ε-contamination uncer-tainty models. Our aim here is to give theoretical solutions to the problem under more advanced and informative (p-box) uncertainty model and generalise the approach to calculate the theoretical solutions for linear programming problems. The approach is to convert the optimisation

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	problem under uncertainty to a decision problem using imprecise decision theory where the uncertainty is eliminated. We investigate what theoretical results can be obtained for probability box type of uncertainty model and compare them to classical cases for two different optimality criteria: maximinity and maximality.
TF1-098	Prediction of Bottleneck Points for Manipulation Planning in Cluttered Environment using a 3D Convolutional Neural Network **Indraneel Patil**, B.K. Rout, V. Kalaichelvi BITS Pilani, United Arab Emirates **Abstract**—Latest research in industrial robotics is aimed at making human robot collaboration possible seamlessly. For this purpose, industrial robots are expected to work on the fly in unstructured and cluttered environments and hence the subject of perception driven motion planning plays a vital role. Sampling based motion planners are proven to be the most effective for such high dimensional planning problems with real time constraints. Unluckily random stochastic samplers suffer from the phenomenon of 'narrow passages' or bottleneck regions which need targeted sampling to improve their convergence rate. Also identifying these bottleneck regions in a diverse set of planning problems is a challenge. In this paper an attempt has been made to address these two problems by designing an intelligent 'bottleneck guided' heuristic for a Rapidly Exploring Random Tree Star (RRT*) planner which is based on relevant context extracted from the planning scenario using a 3D Convolutional Neural Network and it is also proven that the proposed technique generalizes to unseen problem instances. This paper benchmarks the technique (bottleneck guided RRT*) against a 10% Goal biased RRT* planner, shows significant improvement in planning time and memory requirement and uses ABB 1410 industrial manipulator as a platform for implantation and validation of the results.