

AMC 2020

IEEE 16th International Workshop
on Advanced Motion Control

September 14-16



IEEE



UiA University
of Agder

Welcome Message from AMC2020 General Co-Chairs

On behalf of the Organizing Committees and Industrial Electronics Society of the IEEE, it is our pleasure to welcome you to the IEEE International Workshop on Advanced Motion Control (AMC2020) on September 14-16, 2020 (postponed from April 20-22, 2020 due to COVID-19), at the University of Agder, Campus Kristiansand, in Norway. AMC2020 is 16th in a series of biennial international workshops on Advanced Motion Control, started in 1990 in Yokohama, Japan, and since there uniting an always young and enthusiastic research community grown around the omnipresent motion control technologies and applications. Following to the previous AMC2018 in Tokyo, Japan, our wish is to continue bringing together the researchers from both academia and industry and to maintain a highest scientific conference level, with enriching meetings and discussions and interesting and memorable events and experiences.

Kristiansand is chosen to host AMC2020 as the most southern part of Norway, with its beautiful nature, high integration of local industries, and the University of Agder as an important host for academic and applied research in the Agder region. Kristiansand down-town area is attractive and pleasant to discover for visitors, and the well-connected University Campus Kristiansand provides convenient and modern facilities for hosting the scientific workshops and conferences.

For preparing this event and bringing it to success, we would like to thank all volunteering members of the Organizing Committees for their readiness to serve and continuous contribution to AMC2020. We want to gratefully acknowledge the sponsoring societies and organizations: The Institute of Electrical and Electronics Engineers (IEEE), the IEEE Industrial Electronics Society (IES), and the University of Agder. We also deeply thank to the technical co-sponsors: Industry Applications Society of IEEJ, Measurement & Automatic Control Society of VDI/VDE, and Mechatronics Innovation Lab.

The Technical Program Committee selected 57 papers from 17 countries worldwide, after a thorough review process of the all received manuscripts submitted to technical tracks and organized special sessions. Three invited plenary sessions and a frontier lecture will provide additional opportunities for stimulating and developing ideas and exciting scientific exchange in the motion control, its theories and applications.

Due to COVID-19 developments in August, we had, unfortunately, to change AMC2020 to a fully virtual online event. Despite this drastic change-over and being no longer able to warmly welcome our authors and guests in person in Kristiansand, all originally planned sessions of AMC2020 have been converted into digital space. We much value keeping same traditions of the chaired, moderated, and interactive sessions of AMC and organize the digital conference as life and online as possible, this way providing forum for discussions and active attendance of the presenters and auditorium. The digital AMC2020 is also accompanied by the social events and ceremonies, with speeches and announcements and, above all, original recorded music performances and tours.

We hope that the workshop will satisfy your highest intellectual and cultural expectations and wish you to enjoy all technical and social aspects of AMC2020.

Michael Ruderman
University of Agder

Makoto Iwasaki
Nagoya Institute of Technology

AMC2020 Organizing Committees

Advisory Committee:

Antonio Luque Estepa, University of Seville, Spain
Kiyoshi Ohishi, Nagaoka University of Technology, Japan
Kouhei Ohnishi, Keio University, Japan
Leopoldo Franquelo, University of Seville, Spain
Maarten Steinbuch, Eindhoven University of Technology, Netherlands
Xinghuo Yu, Royal Melbourne Institute of Technology, Australia

General Co-Chairs:

Michael Ruderman, University of Agder, Norway
Makoto Iwasaki, Nagoya Institute of Technology, Japan

Technical Program Co-Chairs:

Alexey Pavlov, NTNU Trondheim, Norway
Hiroshi Fujimoto, University of Tokyo, Japan
Roberto Oboe, University of Padova, Italy

Special Session Co-Chairs:

Kenta Seki, Nagoya Institute of Technology, Japan
Sehoon Oh, Daegu Gyeongbuk Institute of Science and Technology, Korea
Tom Oomen, Eindhoven University of Technology, Netherlands

Publication Co-Chairs:

Damiano Padovani, University of Agder, Norway
Tomoyuki Shimono, Yokohama National University, Japan

Publicity Co-Chairs:

Toshiaki Tsuji, Saitama University, Japan
Valentin Ivanov, Technical University Ilmenau, Germany

Technical Program Committee:

Andrew Fleming, University of Newcastle, Australia
Anton Shiriaev, NTNU Trondheim, Norway
Goele Pipeleers, KU Leuven, Belgium
Jan Tommy Gravdahl, NTNU Trondheim, Norway
Johann Reger, Technical University Ilmenau, Germany
Kazuaki Ito, Gifu University, Japan
Kenji Natori, Chiba University, Japan
Kenn Oldham, University of Michigan, USA
Kyoungchul Kong, Sogang University, Korea
Marina Indri, Politecnico di Torino, Italy
Martin Steinberger, TU Graz, Austria
Michael Rygaard Hansen, University of Agder, Norway
Mikael Norrlof, ABB Robotics, Sweden
Seiichiro Katsura, Keio University, Japan
Stanislav Aranovskiy, Centrale Supélec, France
Yasutaka Fujimoto, Yokohama National University, Japan
Yoshihiro Maeda, Nagoya Institute of Technology, Japan

Local arrangements Co-Chair:

Elisabeth Rasmussen, University of Agder

Local arrangements Committee:

Anne Augland, University of Agder
Leif Arne Løhaugen, University of Agder
Morten Kjeld Ebbesen, University of Agder



Technical Program Reviewers:

Abdul Muis
Ahmad Zaki Bin Shukor
Aksel Transeth
Aleksi Tepljakov
Ales Hace
Alessandro Victorino
Alexander Pogromsky
Alexey Pavlov
Andrea Tilli
Andreas Rauh
Andrei Aksjonov
Andrew Fleming
Andrzej Dzieliński
Anton Shiriaev
Antonella Ferrara
Antonio Lopes
Arvid Keemink
Ashwin Narayan

Barkan Ugurlu
Boris Andrievsky
Brad Saund
Byeonghun Na
Correa Victorino
Daisuke Yashiro
Danijel Pavkovic
Dario Richiedi
Dinko Osmankovic
Dzmitry Savitski
Edmund Forland Brekke
Eiichi Saito
Emre Ozsoy
Emre Sariyildiz
Eray Baran
Geoff Downton
Goele Pipeleers
Hiroaki Kuwahara

Hiroshi Fujimoto
Hiroshi Igarashi
Ilia Polushin
Issam Smadi
Jan Tommy Gravdahl
Jasmin Kevric
Joan Vazquez Molina
Johann Reger
John Hung
Jorge Solis
Junyoung Lee
Kazuaki Ito
Kazuhiro Yubai
Kenan Isik
Kenji Natori
Kenn Oldham
Kenta Nagano
Kenta Seki

Koichi Sakata
Kristian Gaustad Hanssen
Kyoungchul Kong
Luis Tupak Aguilar
Makoto Iwasaki
Mami Sataka
Marcel Heertjes
Marina Indri
Markus Lemmen
Martin Steinberger
Masahide Ito
Masato Koyama
Merve Acer
Michael Ruderman
Mikael Norrlof
Ming-Yang Cheng
Mohit Verma
Naoki Motoi

Naoki Oda
Nard Strijbosch
Noud Mooren
Ohung Kwon
Olav Egeland
Phi Van Lam
Rafael Tavares
Rahim Mutlu
Renato Galluzzi
Riccardo Antonello
Roberto Oboe
Ryogo Kubo
Sakahisa Nagai
Satoshi Komada
Sehoon Oh
Seiichiro Katsura
Shin-ichi Ito
Shota Yabui

Soon-O Kwon
Sota Shimizu
Stanislav Aranovskiy
Takahiro Nozaki
Taro Takahashi
Tom Oomen
Tomas Svoboda
Tomoyuki Shimono
Toshiaki Tsuji
Toshimasa Miyazaki
Valentin Ivanov
Wataru Ohnishi
Wen-Hua Chen
Yasutaka Fujimoto
Yoshiyuki Urakawa
Yuki Yokokura
Yutaka Uchimura

General Information

Conference Venue

University of Agder, Campus Kristiansand
Universitetsveien 25, 4630 Kristiansand, Norway

Registration Desk

Time: (initially 20-22.04.2020 from 08:00-16:00)
Place: (initially University of Agder, Campus Kristiansand, B-building, in front of the main entrance)

Wi-Fi connection

During the conference the free of charge internet Wi-Fi connection is available.

Coffee breaks

All coffee breaks take place at the conference area, on the first floor close to Registration Desk.

Lunch breaks

Lunches will be served in the Canteen, on the ground floor of main building.

Welcome Reception

Time: Monday September 14th, 15:20-16:00 (initially April 20th, 18:00-20:00)
Place: Digital Room A (initially Scandic Bystranda hotel)
If you have signed up for Welcome Reception, please bring the ticket "Welcome Reception" given in your Participant Letter.
One drinking unit and snacks are included. Additional drinks are at your own cost.

Conference Social Event (initially Conference Dinner)

Time: Tuesday September 15th, 15:50-17:00 (initially April 21st, 19:00-23:00)
Place: Digital Room A (initially Christiansholm Fortress)
If you have signed up for Welcome Reception, please bring the ticket "Conference Dinner" given in your Participant Letter.
Three-course dinner and 2 drinking units plus aperitif at the entrance are included. Additional drinks are at your own cost.

Virtual tour (initially Cultural tour: Hunsfos Brewery)

Time: Wednesday September 16th, 12:50-13:30 (initially April 22nd, 13:10-16:00)
Place: Digital Room B (initially Hunsfos Brewery, Vennesla)
Bus from and back to the Campus Kristiansand; stops at the conference hotels on return.
Guided tour at the brewery, beer tasting, and food.

Technical tour: Mechatronics Innovation Lab

Time: Wednesday September 16th, 12:50-13:30 (initially April 22nd, 13:10-16:00)
Place: Digital Room C (initially Campus Grimstad)
Bus from and back to the Campus Kristiansand; stops at the conference hotels on return.
Guided tour at the Mechatronics Innovation Lab in Campus Grimstad.

Conference participants policies

All presentation and conference activities are conducted in the English language. The participants are obligated to carry the name badge. The participants are not expected to take pictures of or record the presentations, since it can violate consent from the presenters.

Access to Campus Kristiansand

Buses to/from Campus Kristiansand

There are several buses between the city center and Campus Kristiansand:

M1, M2, M3, M4, 12, 15, 19, 35, 36, 59.

Schedule of AKT public buses can be found: <https://www.akt.no/english/info-in-english/travel/>

We suggest taking a bus from "Kristiansand rutebilstasjon" to "Universitetet (Kristiansand)":

"Kristiansand rutebilstasjon" is about 5-10 min walking distance from the conference hotels.

You get off at Universitetet/Spicheren bus stop and walk about 3 min to the Campus B-building.

Bus pass/tickets

You will find the valid period ticket for buses for all three conference days in the conference bag. Period ticket is not valid for the night bus, airport bus, and commercial express buses. The bus cards are touchless smart cards; you must hold the bus card over the card reader, upon the entrance to the bus, until the reader screen lights up green.

On foot

If the weather permits, it is possible to walk to Campus from the city center; this would take about 40-45 minutes.

Taxi

Taxi can be ordered on the following numbers:

Taxi Sør +47 38 02 80 00

Agder Taxi +47 07000

Emergency

In case of emergency, following numbers are to be used:

Fire 110

Police 112

Ambulance 113

Insurance

Participants of AMC2020 are advised to take out their own insurance in case of emergency illness or lost baggage. The conference registration fees DO NOT include any provisions for the insurance of participants against personal injuries, sickness, and theft or property damage.

Currency

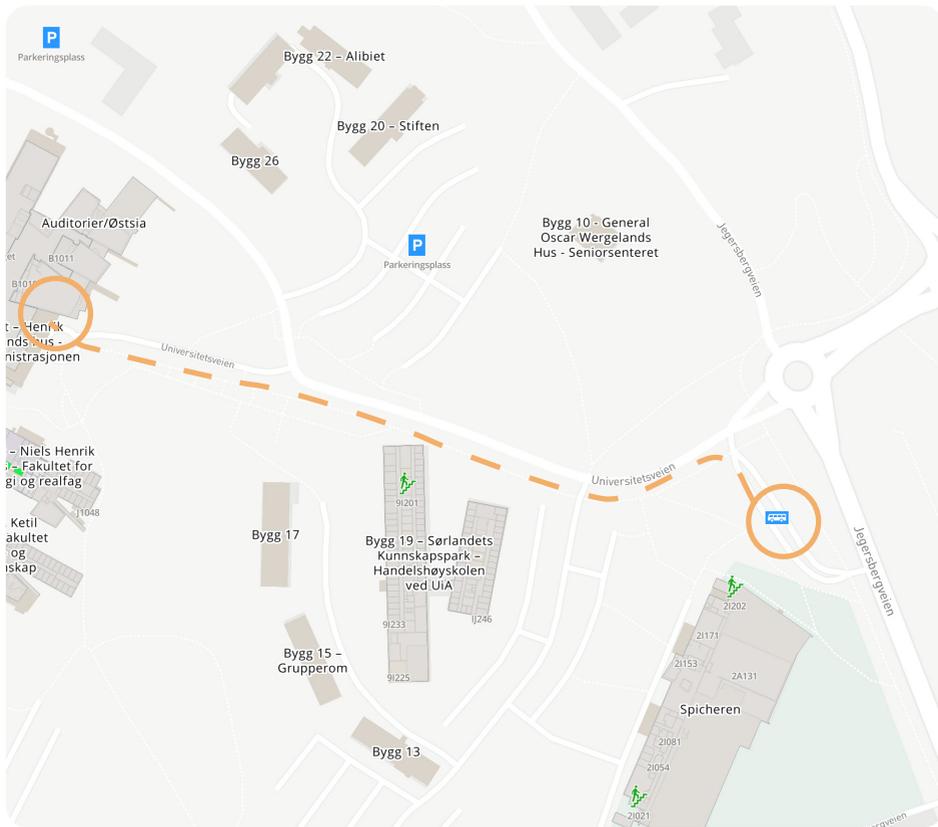
The official currency is Norwegian Krone (NOK).

All major credit cards are accepted in the most hotels, stores, and restaurants.

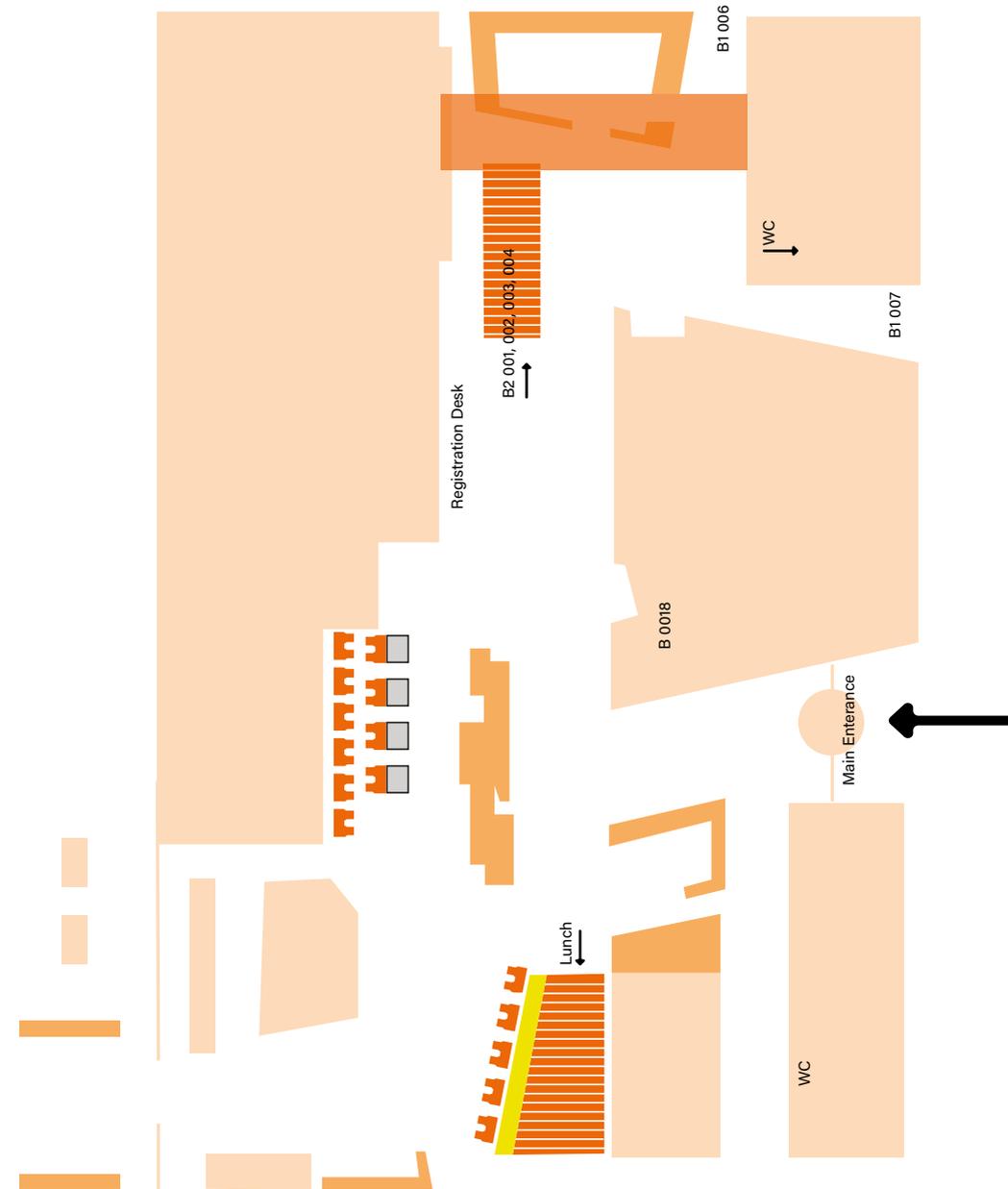
Power Supply

230V AC, 50 Hz

Busstop to main entrance



Orientation and Campus



Workshop Program Overview

Monday, September 14, 2020

9:00-9:10, Room A Opening Ceremony	
9:10-10:00, Room A Plenary Session I	
10:00-10:10, Coffee break (individual)	
10:10-11:50, Room B TT – Robotics and mechatronics	10:10-11:50, Room C SS – Soft motion for advanced human-robot- interaction – I
11:50-12:30, Lunch break (individual)	
12:30-13:20, Room A Frontier Lecture	
13:20-13:30, Coffee break (individual)	
13:30-15:10, Room B TT – Complex dynamics and nonlinear control	13:30-15:10, Room C SS – Soft motion for advanced human-robot- interaction – II
15:10-15:20, Coffee break (individual)	
15:20-16:00, Room A Welcome Reception	

Tuesday, September 15, 2020

09:00-10:40, Room B TT – Motion control – I	09:00-10:40, Room C SS – Smart precision motion control in mechatronic systems
10:40-10:50, Coffee break (individual)	
10:50-12:30, Room B TT – Motion control – II	10:50-12:30, Room C TT – Force control, haptics, and HMI – I
12:30-13:10, Lunch break (individual)	
13:10-14:50, Room B TT – Motion control – III	13:10-14:50, Room C TT – Force control, haptics, and HMI – II
14:50-15:00, Coffee break (individual)	
15:00-15:50, Room A Plenary session II	
15:50-17:00, Room A Conference Social Event	

Wednesday, September 16, 2020

9:00-9:50, Room A Plenary session III	
9:50-10:00, Coffee break (individual)	
10:00-11:40, Room B TT – Automotive and vehicular motion systems	10:00-11:40, Room C SS – Intelligent sensing applications for human assistive systems
11:40-12:10, Room A Closing Ceremony	
12:10-12:50, Lunch break (individual)	
12:50-13:30, Virtual Tour	12:50-13:30, Technical Tour

Attending digital AMC2020

Virtual online AMC2020 takes place in a digital space, in the scheduled Rooms A, B, and C. All registered AMC2020 participants receive access to the digital space for all conference sessions. The scheduled Coffee and Lunch breaks are individual, and there are no activities in the digital rooms. All AMC2020 sessions are chaired and moderated. During the presentations, the microphones are on mute for auditorium, while during the questions and discussions round the session chairs give word to audience and moderate the digital podium. Each digital room has a technical assistance for broadcasting the pre-recorded presentations on time. All presentations in the technical track and special sessions are scheduled for 20 min timeslot each, and the plenary sessions and frontier lecture are scheduled for 50 min timeslot each. The auditorium can also use chat functionality to pass questions to the presenters. The digital sessions will be recorded and made available online after the conference.

Invited Speakers

Plenary Session I

Discussion on sensing and actuating to support human activities from a view point of intelligent space



Prof Hideki Hashimoto
Chuo University

Abstract:

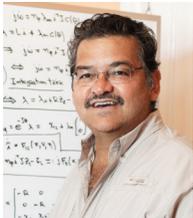
When I started my research works with a name of Intelligent Space, the main idea was "We should use our technologies to support our human activities with keeping good health conditions". It means that the intelligent space should understand human behaviors and to provide proper physical support by using robotics. The Intelligent Space is focusing to fuse IT and Robotics in our daily life. I believe that such research direction is still important even if actual state of ongoing intelligent space is remaining in lower stages. In this talk I will show some current results of monitoring human health conditions, assisting human mobilities and elementary technologies for actuators from a view point of Intelligent Space to discuss our important research issues.

Biography:

Hideki Hashimoto (IEEE Fellow, SICE Fellow, RSJ Fellow) received the B.S., M.S. and Dr. of Engineering from the Department of Electrical Engineering, University of Tokyo in 1981, 1984 and 1987 respectively. He joined the Institute of Industrial Science of the University of Tokyo as a lecturer in April of 1987. He was an associate professor from July of 1990 until March of 2011. He has been a professor at Dept. of Electrical, Electronics and Communication Engineering, Chuo University, Tokyo, Japan since April of 2011. He was a visiting scientist at LIDS (Laboratory for Information and Decision System) and LEES (Laboratory for Electromagnetic and Electronic Systems) of MIT from September of 1989 to August of 1990. He was an Invited Distinguished Professor at Seoul National University from 2009 to 2012, and a Visiting Professor at Budapest University of Technology and Economics from 2009 to 2011. He is a visiting professor at Budapest University of Technology and Economics from 2014. He was the founding general chair of 1997 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM). He was a program chair of IEEE/RSJ IROS in 1988 and 2000, and a general chair of IEEE ITS Conference in 2002 and IECON 2015. His research topics are Intelligent Space, Intelligent Systems, Mechatronics, Robotics and Control.

Penary Session II

Parameter estimation and gradient descent-based observers: application to mechanical and electromechanical systems



**Prof
Romeo Ortega**
Department of
Digital Systems,
ITAM

Abstract:

In the first part of the talk we present a new approach to state observation, called Parameter Estimation-based Observers (PEBO) whose main idea is to translate the state estimation problem into one of estimation of constant, unknown parameters. The class of systems for which is applicable is identified via two assumptions related to the transformability of the system into a suitable cascaded form and our ability to estimate the unknown parameters. The first condition involves the solvability of a partial differential equation while the second one requires some persistency of excitation-like conditions. We present also PEBO in a unified framework together with the – by-now classical – Kasantzis-Kravaris-Luenberger and Immersion and Invariance observers. In the second part we show that, for systems for which a linear regression-like relation is available, it is possible to combine PEBO with a new estimation technique called Dynamic Regressor Extension and Mixing (DREM). This new technique, called DREMBAO, is used to generate adaptive observers. PEBO and DREMBAO are shown to be applicable to position estimation of a class of electromechanical systems – including motors and MagLev systems – and for speed observation of a class of mechanical systems. The performance of these observers is compared with high-gain and sliding mode observers. As expected, it is shown that – in the presence of noise – the performance of the two latter designs is significantly below par with respect to the other techniques.

Biography:

Romeo Ortega was born in Mexico. He obtained his BSc in Electrical and Mechanical Engineering from the National University of Mexico, Master of Engineering from Polytechnical Institute of Leningrad, USSR, and the Docteur D`Etat from the Polytechnical Institute of Grenoble, France in 1974, 1978 and 1984 respectively. He then joined the National University of Mexico, where he worked until 1989. He was a Visiting Professor at the University of Illinois in 1987-88 and at McGill University in 1991-1992, and a Fellow of the Japan Society for Promotion of Science in 1990-1991. He was a member of the French National Research Council (CNRS) from June 1992 to July 2020, where he was a "Directeur de Recherche" in the Laboratoire de Signaux et Systemes (CentraleSupélec) in Gif-sur-Yvette, France. Currently, he is a full time Professor at ITAM in Mexico City, Mexico. His research interests are in the fields of nonlinear and adaptive control, with special emphasis on applications. Dr Ortega has published five books and more than 350 scientific papers in international journals, with an h-index of 84. He has supervised more than 35 PhD thesis. He is a (Life) Fellow Member of the IEEE since 1999 (Life 2020) and an IFAC Fellow since 2016. He has served as chairman in several IFAC and IEEE committees and participated in various editorial boards of international journals. He is currently Editor in Chief of Int. J. Adaptive Control and Signal Processing and Senior Editor of Asian Journal of Control.

Plenary Session III

Vision for robotics



**Prof
Annette Stahl**
Norwegian
University of
Science and
Technology
(NTNU)

Abstract:

Reproducing the capabilities of visual sensing that one can find in nature would provide a very powerful and highly desired tool for robots. Ideally this enables a robot to perceive and interpret its surrounding so that it can use this information to execute different tasks within a real world environment. As robots operate in various environments (indoors, in space, in air, underwater) equipped with different sets of visual sensing devices (standard cameras, time-of-flight cameras, structured light cameras, hyperspectral imager) this makes the generic "interpretation of the world around a robot" very challenging. In this presentation I wish to introduce you to certain aspects within the world of "robotic vision" - where we try to teach machines to understand, plan and act in an intelligent way. In particular we will be concerned with how robots might build concepts about objects, understand relations between objects and understand the 3D structure of the surrounding world. The analysis of motion in the world of a robot is also an integral part of this understanding and important for many robotic control tasks.

Biography:

Annette Stahl is Head of the Robotic Vision Group at the Department of Engineering Cybernetics at the Norwegian University of Science and Technology – NTNU, Norway. She is also an Affiliated Scientist of the Center of Excellence for Autonomous Marine Operations and Systems – NTNU AMOS. She received her PhD degree from the University of Heidelberg, Germany in applied mathematics with the main focus on computer vision applications in relation to variational methods for motion estimation using physical prior knowledge. She spent two years as a postdoc at the School of Computing, Dublin City University – DCU, Ireland and three years at the Department of Mathematical Sciences, NTNU, Norway, where she worked on isogeometric analysis based methods for graphics and visualization. After this period she worked as a researcher at the High Performance Computing Group at NTNU and at SINTEF Ocean, Norway, where she was concerned with computer vision based aquaculture applications. In 2016, her was awarded an Onsager Fellowship from NTNU's Research Excellence. She is currently working within the field of robotic vision targeting underwater, on sea surface, on land, in air and space as well as indoor and industrial related robotic applications.

Frontier Lecture

Learning for advanced motion control



**Prof
Tom Oomen**
Eindhoven
University of
Technology

Summary:

Do you also have a motion system that has the same error in each task? Iterative Learning Control (ILC) can achieve perfect performance for your system. A general learning framework is presented that exploits measured error signals from previous tasks. By employing very simple models, both fast and safe learning is achieved, guaranteeing a reduction of the error in each experiment. Typically, perfect performance is achieved in only five to ten iterations. A complete design framework for motion systems is provided, while at the same time touching upon the essential theoretical foundations, including non-causality of the optimal design and the connection to traditional feedback and feedforward designs. Finally, recent approaches are explored that facilitate the implementation on industrial systems, including flexibility for a large class of tasks and multivariable systems.

Biography:

Tom Oomen received the M.Sc. degree (cum laude) and Ph.D. degree from the Eindhoven University of Technology, Eindhoven, The Netherlands. He held visiting positions at KTH, Stockholm, Sweden, and at The University of Newcastle, Australia. Presently, he is associate professor with the Department of Mechanical Engineering at the Eindhoven University of Technology. He is a recipient of the Corus Young Talent Graduation Award, the IFAC 2019 TC 4.2 Mechatronics Young Research Award, the 2015 IEEE Transactions on Control Systems Technology Outstanding Paper Award, the 2017 IFAC Mechatronics Best Paper Award, the 2019 IEEE Journal of Industry Applications Best Paper Award, and recipient of a Veni and Vidi personal grant. He is Associate Editor of the IEEE Control Systems Letters (L-CSS), IFAC Mechatronics, and IEEE Transactions on Control Systems Technology. He is a member of the Eindhoven Young Academy of Engineering. His research interests are in the field of data-driven modeling, learning, and control, with applications in precision mechatronics.

Technical Program

Monday 14 September

Opening Ceremony: Opening Ceremony

Room: Room A
Day: Monday 14 September
Time: 09:00
Duration: 10 minutes

Chair

Michael Ruderman

Plenary Session I

Room: Room A
Day: Monday 14 September
Time: 09:10
Duration: 50 minutes

Discussion on sensing and actuating to support human activities from a view point of intelligent space

Speaker

Prof Hideki Hashimoto, Chuo University, Japan

Chair

Makoto Iwasaki

Oral Session: TT – Robotics and mechatronics

Room: Room B
Day: Monday 14 September
Time: 10:10
Duration: 80 minutes

Chairs

Arne Wahrburg and Kenta Seki

Papers

Time:10:10

Title: ND-000353. Extending Dynamic Movement Primitives towards High-Performance Robot Motion

Authors:

Dr. Arne Wahrburg, ABB Corporate Research, Germany
Mr. Simone Guida, Politecnico di Milano, Italy
Dr. Nima Enayati, ABB Corporate Research, Germany
Prof. Andrea M. Zanchettin, Politecnico di Milano, Italy
Prof. Paolo Rocco, Politecnico di Milano, Italy

Time:10:30

Title: ND-000035. Development of Pushing Control Mechanisms for Generator Inspection Robot

Authors:

Mr. Hiroaki Kuwahara, TOSHIBA Corporation, Japan
Mr. Kazuma Hiraguri, TOSHIBA Corporation, Japan
Dr. Fujio Terai, TOSHIBA Energy Systems and Solutions Corporation, Japan

Time:10:50

Title: ND-000345. Distributed Interpolation: Synchronization of motion-controlled axes with coordination vector and decentralized segment controllers

Authors:

Ms. Caren Dripke, Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW), University of Stuttgart, Germany
Mr. Daniel Schoebel, Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW), University of Stuttgart, Germany
Prof. Alexander Verl, Institute for Control Engineering of Machine Tools and Manufacturing Units (ISW), University of Stuttgart, Germany

Time:11:10

Title: ND-000957. Collaborative Transport by Mecanum Mobile Robots using Reaction Torque Observer

Authors:

Mr. Maximilien Tsuji, Keio University, Japan
Prof. Toshiyuki Murakami, Keio University, Japan

Oral Session: SS

- Soft motion for advanced human-robot-interaction - I

Room: Room C
Day: Monday 14 September
Time: 10:10
Duration: 100 minutes

Chairs

Tomoyuki Shimono and Sehoon Oh

Papers

Time:10:10

Title: ND-001023. Development of Compact Linear Actuator Combining DC motor and Cylindrical Cam for Tactile Display

Authors:

Dr. Sakahisa Nagai, The University of Tokyo, Japan
Prof. Atsuo Kawamura, Yokohama National University, Japan

Time:10:30

Title: ND-000698. A High-Torque Density Compliant Actuator Design for Physical Robot Environment Interaction

Authors:

Mr. Evan Dunwoodie, Uow, Australia
Dr. Rahim Mutlu, Uow, Australia
Dr. Barkan Ugurlu, Ozu, Turkey
Mr. Mehmet Yildirim, Ozu, Turkey
Dr. Tarik Uzunovic, Uos, Bosnia and Herzegovina
Dr. Emre Sariyildiz, Uow, Australia

Time:10:50

Title: ND-000477. Human-Adaptive Impedance Control Using Recurrent Neural Network for Stability Recovery in Human-Robot Cooperation

Authors:

Ms. Misaki Hanafusa, Tokyo Denki University, Japan
Prof. Jun Ishikawa, Tokyo Denki University, Japan

Time:11:10

Title: ND-001163. Novel Algorithm for Position/Force Control of Multi-DOF Robotic Systems

Authors:

Prof. Tarik Uzunovic, University of Sarajevo - Faculty of Electrical Engineering, Bosnia and Herzegovina
Prof. Asif Sabanovic, International University of Sarajevo, Bosnia and Herzegovina
Mr. Minoru Yokoyama, Yokohama National University, Japan
Prof. Tomoyuki Shimono, Yokohama National University, Japan

Time:11:30

Title: ND-001279. Transparent Torque Sensor-less Impedance Rendering for Low-cost Direct Drive Motor

Authors:

Mr. Chan Lee, Dgist, Korea (South)
Mr. Sangjin Bae, Dgist, Korea (South)
Mr. Woosong Kang, Dgist, Korea (South)
Prof. Sehoon Oh, Dgist, Korea (South)

Frontier Lecture

Room: Room A
Day: Monday 14 September
Time: 12:30
Duration: 50 minutes

Learning for Advanced Motion Control

Speaker

Prof. Tom Oomen, Eindhoven University of Technology, Netherlands

Chair

Alexey Pavlov

Oral Session: TT - Complex dynamics and nonlinear control

Room: Room B
Day: Monday 14 September
Time: 13:30
Duration: 100 minutes

Chair

Christian Fredrik Sætre

Papers

Time:13:30

Title: ND-000515. Event-Triggered Sliding Mode Control Strategies for Positioning Systems: An Experimental Assessment

Authors:

Dr. Andrej Sarjaš, University of Maribor, Slovenia
Prof. Martin Steinberger, Graz University of Technology, Austria
Prof. Dušan Gleich, University of Maribor, Slovenia
Prof. Martin Horn, Graz University of Technology, Austria

Time:13:50

Title: ND-000906. Fractional-Order System Identification of Viscoelastic Behavior: A Frequency Domain Based Experimental Study

Authors:

Ms. Daniela Kapp, TU Ilmenau, Germany
Mr. Christoph Weise, TU Ilmenau, Germany
Prof. Michael Ruderman, University of Agder, Norway
Prof. Johann Reger, TU Ilmenau, Germany

Time:14:10

Title: ND-000728. On Orbital Stabilization as an alternative to Reference Tracking Control

Authors:

Mr. Christian Fredrik Sætre, NTNU, Norway
Prof. Anton Shiriaev, NTNU, Norway

Time:14:30

Title: ND-001309. A Fractional-Order Control Approach to Ramp Tracking with Memory-Efficient Implementation

Authors:

Mr. Christoph Weise, TU Ilmenau, Germany
Mr. Rafael Tavares, University of Agder, Norway
Dr. Kai Wulff, TU Ilmenau, Germany
Prof. Michael Ruderman, University of Agder, Norway
Prof. Johann Reger, TU Ilmenau, Germany

Time:14:50

Title: ND-000892. Regulation of Penetration Rate and Drilling Power in Rotary Drilling Systems

Authors:

Mr. Maksim V. Faronov, Western University, Canada
Dr. Ilia G. Polushin, Western University, Canada

Oral Session: SS

- Soft motion for advanced human-robot-interaction - II

Room: Room C
Day: Monday 14 September
Time: 13:30
Duration: 100 minutes

Chairs

Sehoon Oh and Tarik Uzunovic

Papers

Time:13:30

Title: ND-001171. Development and Basic Analysis of Novel Flexible Linear Motor

Authors:

Mr. Hiroshi Asai, Kanagawa Institute of Industrial Science and Technology, Japan
Prof. Tomoyuki Shimono, Yokohama National University, Kanagawa Institute of Industrial Science and Technology, Japan
Ms. Tomoe Deguchi, KRI Incorporated, Japan
Mr. Yasuhisa Fujii, KRI Incorporated, Japan
Mr. Hitoshi Yamamoto, KRI Incorporated, Japan
Prof. Kouhei Ohnishi, Haptics Research Center, Kanagawa Institute of Industrial Science and Technology, Japan

Time:13:50

Title: ND-000205. Soft Boom Cylinder Control Using Disturbance-Observer-Based Equivalent Hydraulic System for Electric Excavator

Authors:

Mr. Rintaro Nakano, Nagaoka University of Technology, Japan
Prof. Kiyoshi Ohishi, Nagaoka University of Technology, Japan
Prof. Yuki Yokokura, Nagaoka University of Technology, Japan

Time:14:10

Title: ND-000604. An Approach to Force Control by Model Predictive Velocity Control with Constraints

Authors:

Mr. Takashi Ohhira, Keio University, Japan
Prof. Toshiyuki Murakami, Keio University, Japan

Time:14:30

Title: ND-000752. A Method to Make a Robot Understand What was a Target Object in Motion Copying System

Authors:

Mr. Xiaobai Sun, Keio University, Japan
Dr. Takahiro Nozaki, Keio University, Japan
Prof. Toshiyuki Murakami, Keio University, Japan
Prof. Kouhei Ohnishi, Keio University, Japan

Time:14:50

Title: ND-001295. Ripple Minimization for Harmonic-gear Series Elastic Actuator under Force Control

Authors:

Mr. Woosong Kang, Dgist, Korea (South)
Mr. Chan Lee, Dgist, Korea (South)
Mr. Sangin Bae, Dgist, Korea (South)
Prof. Sehoon Oh, Dgist, Korea (South)

Welcome Reception: Welcome Reception

Room: Room A
Day: Monday 14 September
Time: 15:20
Duration: 40 minutes

Tuesday 15 September

Oral Session: TT - Motion control - I

Room: Room B
Day: Tuesday 15 September
Time: 09:00
Duration: 100 minutes

Chairs

Tomoyuki Shimono and Enzo Evers

Papers

Time:09:00

Title: ND-001147. Feedback Controller Design Based on H-infinity Control Theory in Dynamically Substructured System

Authors:

Mr. Ryo Ishibashi, Nagoya Institute of Technology, Japan
Prof. Kenta Seki, Nagoya Institute of Technology, Japan
Prof. Makoto Iwasaki, Nagoya Institute of Technology, Japan

Time:09:20

Title: ND-000175. Experimental comparison of velocity estimators for a control moment gyroscope inverted pendulum

Authors:

Dr. Dmitry Sokolov, Université de Lorraine, France
Dr. Stanislav Aranovskiy, CentaleSupélec - IETR, France
Mr. Alexander Gusev, Kuban State University, Russian Federation
Dr. Igor Ryadchikov, Kuban State University, Russian Federation

Time:09:40

Title: ND-000531. Controller design of mass flow rate loop for high-precision pneumatic actuator

Authors:

Ms. Shirato Yui, The University of Tokyo, Japan
Prof. Ohnishi Wataru, The University of Tokyo, Japan
Prof. Fujimoto Hiroshi, The University of Tokyo, Japan
Prof. Koseki Takafumi, The University of Tokyo, Japan
Prof. Hori Yoichi, The University of Tokyo, Japan

Time:10:00

Title: ND-000442. A simple quasi-LPV approach to control design of an industrial wind turbine

Authors:

Mr. Ali Poureh, Niroo Research Institute, Iran
Mr. Omid Bazzaz, Niroo Research Institute, Iran

Time:10:20

Title: ND-001015. Multi-System Iterative Learning Control: an Extension of ILC for Interconnected Systems.

Authors:

Mr. Daniele Ronzani, Department of Mechanical Engineering, KU Leuven - DMMS lab, Flanders Make, Belgium
Dr. Armin Steinhauser, Department of Mechanical Engineering, KU Leuven - DMMS lab, Flanders Make, Belgium
Prof. Jan Swevers, Department of Mechanical Engineering, KU Leuven - DMMS lab, Flanders Make, Belgium

Oral Session: SS**- Smart precision motion control in mechatronic systems**

Room: Room C
Day: Tuesday 15 September
Time: 09:00
Duration: 80 minutes

Chairs

Kenta Seki and Tom Oomen

Papers**Time:09:00**

Title: ND-000744. On Frequency Response Function Identification for Advanced Motion Control

Authors:

Mr. Enzo Evers, Eindhoven University of Technology, Netherlands
Dr. Robbert Voorhoeve, Eindhoven University of Technology, Netherlands
Dr. Tom Oomen, Eindhoven University of Technology, Netherlands

Time:09:20

Title: ND-000124. Resonant Frequency Damping Disturbance Observer based Robot Servo System

Authors:

Mr. Akinori Yabuki, National Institute of Technology, Ishikawa College, Japan
Prof. Toshiyuki Kanmachi, National Institute of Technology, Ishikawa College, Japan
Prof. Kiyoshi Ohishi, Nagaoka University of Technology, Japan
Prof. Toshimasa Miyazaki, Nagaoka University of Technology, Japan
Prof. Yuki Yokokura, Nagaoka University of Technology, Japan
Prof. Itaru Ando, National Institute of Technology, Akita College, Japan

Time:09:40

Title: ND-000701. Suppressing Position-Dependent Disturbances in Repetitive Control: With Application to a Substrate Carrier System

Authors:

Mr. Noud Mooren, Eindhoven University of Technology, Netherlands
Dr. Gert Witvoet, Eindhoven University of Technology, Netherlands
Mr. Ibrahim Acan, Sioux CCM B.V., Netherlands
Mr. Joep Kooijman, Sioux CCM B.V., Netherlands
Dr. Tom Oomen, Eindhoven University of Technology, Netherlands

Time:10:00

Title: ND-000558. Vibration Amplitude Suppression Control of Industrial Machine Driven at Resonance Frequency

Authors:

Mr. Hikaru Sato, Nagaoka University of Technology, Japan
Mr. Toshimasa Miyazaki, Nagaoka University of Technology, Japan
Mr. Yoshihisa Hojo, Toyo Denki Seizo K.K., Japan

Oral Session: TT - Motion control - II

Room: Room B
Day: Tuesday 15 September
Time: 10:50
Duration: 60 minutes

Chairs

Andrej Sarjas and Bastiaan Vandewal

Papers

Time:10:50

Title: ND-001155. Proposal of Automatic Power Plug Insertion Control for Electric Vehicle with In-Wheel-Motors

Authors:

Mr. Daiki Kusuyama, The University of Tokyo, Japan
Mr. Tomoki Emmei, The University of Tokyo, Japan
Prof. Hiroshi Fujimoto, The University of Tokyo, Japan
Prof. Yoichi Hori, The University of Tokyo, Japan

Time:11:10

Title: ND-001112. 3K Compound Planetary Reduction Gearbox With Non-backlash Mechanism

Authors:

Mr. Satoru Oba, Yokohama National University, Japan
Prof. Yasutaka Fujimoto, Yokohama National University, Japan

Time:11:30

Title: ND-001198. Basic Study on Regenerative Air Brake Using Observer-based Thrust Control for Electric Airplane

Authors:

Mr. Kentaro Yokota, The University of Tokyo, Japan
Prof. Hiroshi Fujimoto, The University of Tokyo, Japan
Prof. Yoichi Hori, The University of Tokyo, Japan

Oral Session: TT – Force control, haptics, and HMI – I

Room: Room C
Day: Tuesday 15 September
Time: 10:50
Duration: 100 minutes

Chairs

Toshiaki Tsuji and Gudmundur Gunnarsson

Papers

Time:10:50

Title: ND-001139. Contact Force Control Based on Force Estimation in Bimorph-type Piezoelectric Actuators

Authors:

Prof. Kenta Seki, Nagoya Institute of Technology, Japan
Mr. Yuya Sakuragi, Nagoya Institute of Technology, Japan
Prof. Makoto Iwasaki, Nagoya Institute of Technology, Japan

Time:11:10

Title: ND-001236. Verification of Double Hand Teleoperation System Using Haptic Forceps Robots and LCLM Platform

Authors:

Dr. Takuya Matsunaga, Kanagawa Institute of Industrial Science and Technology, Japan
Prof. Tomoyuki Shimono, Yokohama National University, Japan
Prof. Kouhei Ohnishi, Keio University, Japan

Time:11:30

Title: ND-001252. Experimental Setup for a Novel Mechanical Force Generator

Authors:

Mr. Mehmet Burak Ekinci, Tubitak, Turkey
Prof. Ulas Yaman, Middle East Technical University, Turkey
Prof. Reşit Soylu, Middle East Technical University, Turkey

Time:11:50

Title: ND-000655. Coactivation Method of Antagonistic Muscle Pairs Using Common and Differential Modes for Functional Electrical Stimulation Control

Authors:

Ms. Akari Takada, Keio University, Japan
Mr. Akira Hirata, Keio University, Japan
Prof. Seiichiro Katsura, Keio University, Japan

Time:12:10

Title: ND-000574. Minimum-Energy State Determination of an Underactuated Suction Cup Gripper Grid

Authors:

Mr. Gudmundur G. Gunnarsson, University of Southern Denmark, Denmark
Prof. Henrik G. Petersen, University of Southern Denmark, Denmark

Oral Session: TT – Motion control – III

Room: Room B

Day: Tuesday 15 September

Time: 13:10

Duration: 100 minutes

Chairs

Daniele Ronzani and Seiichiro Katsura

Papers

Time:13:10

Title: ND-000213. Path Planning for Perception-Driven Obstacle-Aided Snake Robot Locomotion

Authors:

Dr. Kristian G. Hanssen, Sintef Digital, Norway

Dr. Aksel A. Transeth, Sintef Digital, Norway

Dr. Filippo Sanfilippo, University of Agder, Norway

Dr. Pål Liljebäck, Eelume AS, Norway

Prof. Øyvind Stavdahl, Norwegian University of Science and Technology, Norway

Time:13:30

Title: ND-000736. Basic Idea of Quadrant Dynamic Programming for Adaptive Cruise Control to Create Energy Efficient Velocity Trajectory of Electric Vehicle

Authors:

Mr. Mitsuhiro Hattori, The University of Tokyo, Japan

Prof. Hiroshi Fujimoto, The University of Tokyo, Japan

Time:13:50

Title: ND-000418. Motion Control of Large Inertia Loads Using Electrohydrostatic Actuation

Authors:

Mr. Petter Goytil, University of Agder, Norway

Dr. Damiano Padovani, University of Agder, Norway

Time:14:10

Title: ND-001244. Obstacle Avoidance in Path Following using Local Spline Relaxation

Authors:

Mr. Bastiaan Vandewal, MECO Research Team, Department of Mechanical Engineering, KU Leuven and DMMS lab, Flanders Make, Leuven, Belgium

Dr. Joris Gillis, MECO Research Team, Department of Mechanical Engineering, KU Leuven and DMMS lab, Flanders Make, Leuven, Belgium

Mr. Erwin Rademakers, Core Lab MotionS, Flanders Make, Lommel, Belgium

Prof. Goele Pipeleers, MECO Research Team, Department of Mechanical Engineering, KU Leuven and DMMS lab, Flanders Make, Leuven, Belgium

Prof. Jan Swevers, MECO Research Team, Department of Mechanical Engineering, KU Leuven and DMMS lab, Flanders Make, Leuven, Belgium

Time:14:30

Title: ND-000116. Robust Controller Design for Ball Screw Drives with Varying Resonant Mode via μ -synthesis

Authors:

Mr. Tiancheng Zhong, Southeast University, China

Dr. Wencheng Tang, Southeast University, China

Oral Session: TT – Force control, haptics, and HMI – II

Room: Room C

Day: Tuesday 15 September

Time: 13:10

Duration: 60 minutes

Chair

Toshimasa Miyazaki

Papers

Time:13:10

Title: ND-000566. Feature Extraction and Generation of Robot Writing Motion Using Encoder-Decoder Based Deep Neural Network

Authors:

Mr. Masahiro Kamigaki, Keio University, Japan

Prof. Seiichiro Katsura, Keio University, Japan

Time:13:30

Title: ND-000612. Admittance Control Based on a Stiffness Ellipse for Rapid Trajectory Deformation

Authors:

Mr. Masahide Oikawa, Saitama University, Japan
Mr. Kyo Kutsuzawa, Saitama University, Japan
Prof. Sho Sakaino, University of Tsukuba, Japan
Prof. Toshiaki Tsuji, Saitama University, Japan

Time:13:50

Title: ND-001201. Standing Assistance Control based on Voluntary Body Movement within Safety Tolerance

Authors:

Prof. Daisuke Chugo, Kwansai Gakuin University, Japan
Mr. Masahiro Yokota, Kwansai Gakuin University, Japan
Prof. Satoshi Muramatsu, Tokai University, Japan
Prof. Sho Yokota, Toyo University, Japan
Prof. Jin-Hua She, Tokyo University of Technology, Japan
Prof. Hiroshi Hashimoto, Advanced Institute of Industrial Technology, Japan
Mr. Takahiro Katayama, Rt.Works Co., Ltd, Japan
Dr. Yasuhide Mizuta, Rt.Works Co., Ltd, Japan
Mr. Atsushi Koujina, Rt.Works Co., Ltd, Japan

Plenary Session II

Room: Room A
Day: Tuesday 15 September
Time: 15:00
Duration: 50 minutes

**Parameter estimation and gradient descent-based observers:
application to mechanical and electromechanical systems**

Speaker

Prof Romeo Ortega

Chair

Michael Ruderman

Reunion: Conference Social Event

Room: Room A
Day: Tuesday 15 September
Time: 15:50
Duration: 70 minutes

Organizer

Elisabeth Rasmussen

Wednesday 16 September

Plenary Session III

Room: Room A
Day: Wednesday 16 September
Time: 09:00
Duration: 50 minutes

Vision for robotics

Speaker

Prof Annette Stahl

Chair

Hiroshi Fujimoto

Oral Session: TT – Automotive and vehicular motion systems

Room: Room B
Day: Wednesday 16 September
Time: 10:00
Duration: 80 minutes

Chair

Jan Swevers

Papers

Time:10:00

Title: ND-001317. Offline and Online Tyre Model Reconstruction by Locally Weighted Projection Regression

Authors:

Mr. Kunal Iyer, Delft University of Technology, Netherlands
Dr. Barys Shyrokau, Delft University of Technology, Netherlands
Dr. Valentin Ivanov, Technische Universitaet Ilmenau, Germany

Time:10:20

Title: ND-000469. Cooperative Adaptive Cruise Control Algorithms for Vehicular Platoons Based on Distributed Model Predictive Control

Authors:

Ms. Tugba Tapli, AVL Research and Engineering, Turkey
Prof. Mehmet Akar, Bogazici University, Turkey

Time:10:40

Title: ND-000779. Modeling and field-experiments identification of vertical dynamics of vehicle with active anti-roll bar

Authors:

Mr. Rafael Tavares, University of Agder, Norway
Prof. Michael Ruderman, University of Agder, Norway
Mr. Daan Menjoie, DRiV Tenneco Automotive BVBA, Belgium
Dr. Joan Vazquez Molina, DRiV Tenneco Automotive BVBA, Belgium
Mr. Miguel Dhaens, DRiV Tenneco Automotive BVBA, Belgium

Time:11:00

Title: ND-000647. Real-Time Model Predictive Control for a Parallel Hybrid Electric Vehicle using Outer Approximation and Semi-Convex Cut Generation

Authors:

Mr. Massimo De Mauri, KU Leuven, Belgium
Dr. Joris Gillis, KU Leuven, Belgium
Prof. Jan Swevers, KU Leuven, Belgium
Prof. Goele Pipeleers, KU Leuven, Belgium

Oral Session: SS

- Intelligent sensing applications for human assistive systems

Room: Room C

Day: Wednesday 16 September

Time: 10:00

Duration: 100 minutes

Chairs

Hiroshi Igarashi and Sota Shimizu

Papers

Time:10:00

Title: ND-000264. Energy Analysis Method and Walking Simulation with Exoskeleton Assistive Devices

Authors:

Mr. Kaiki Fukutoku, Keio University, Japan
Mr. Kentaro Ominato, Keio University, Japan
Mr. Atsushi Hiraoka, Keio University, Japan
Mr. Maximilien Tsuji, Keio University, Japan
Prof. Toshiyuki Murakami, Keio University, Japan

Time:10:20

Title: ND-000027. Remote Control Method with Tactile Sensation for Underwater Robot with Magnetic Coupling

Authors:

Prof. Naoki Motoi, Kobe University, Japan
Mr. Shoki Nakamura, Kobe University, Japan

Time:10:40

Title: ND-000582. Space-variant Color Point Cloud Measurement System - Enormous Data Reduction using Saliency Map -

Authors:

Prof. Sota Shimizu, Shibaura Institute of Technology, Japan
Ms. Yu Fujita, Shibaura Institute of Technology, Japan
Mr. Naoaki Kameyama, Shibaura Institute of Technology, Japan
Prof. Nobuyuki Hasebe, Waseda University, Japan

Time:11:00

Title: ND-001228. Road and Intersection Detection Using Convolutional Neural Network

Authors:

Mr. Ryuki Higuchi, Yokohama National University, Japan
Prof. Yasutaka Fujimoto, Yokohama National University, Japan

Time:11:20

Title: ND-000981. Haptic Interface for Virtual Reality based on Hybrid Cable-Driven Parallel Robot

Authors:

Mr. Bastien Poitrimol, Tokyo Denki University, Japan
Prof. Hiroshi Igarashi, Tokyo Denki University, Japan

Closing Ceremony

Room: Room A
Day: Wednesday 16
September
Time: 11:40
Duration: 30 minutes

Chair

Michael Ruderman

**Reunion:
Virtual Tour**

Room: Room B
Day: Wednesday 16
September
Time: 12:50
Duration: 40 minutes

Organizer

Elisabeth Rasmussen

**Reunion:
Technical Tour**

Room: Room C
Day: Wednesday 16
September
Time: 12:50
Duration: 40 minutes

Organizer

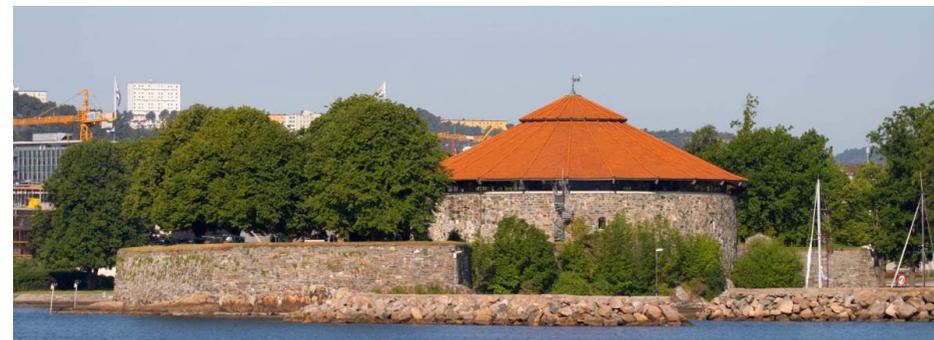
Michael Ruderman

Social Program (initial)



Welcome reception

will be held at Scandic Bystranda hotel, on Monday 20 April from 18:00 to 20:00. All registered participants are welcome to a drink and snack in a pleasant atmosphere of get together. The welcome reception will be accompanied by life music and greeting words.



Conference banquet

will be held at Christiansholm Fortress, on Tuesday 21 April from 19:00 to 23:00. The historical Christiansholm fortress is located middle in the downtown area of Kristiansand, with a beautiful seaside view on the bay, and opens with interior and courtyard for the event. All registered participants are welcome to enjoy the evening and authentic Norwegian food, in a relaxed agreeable atmosphere accompanied by a music performance, also by conference awards ceremony and announcements.

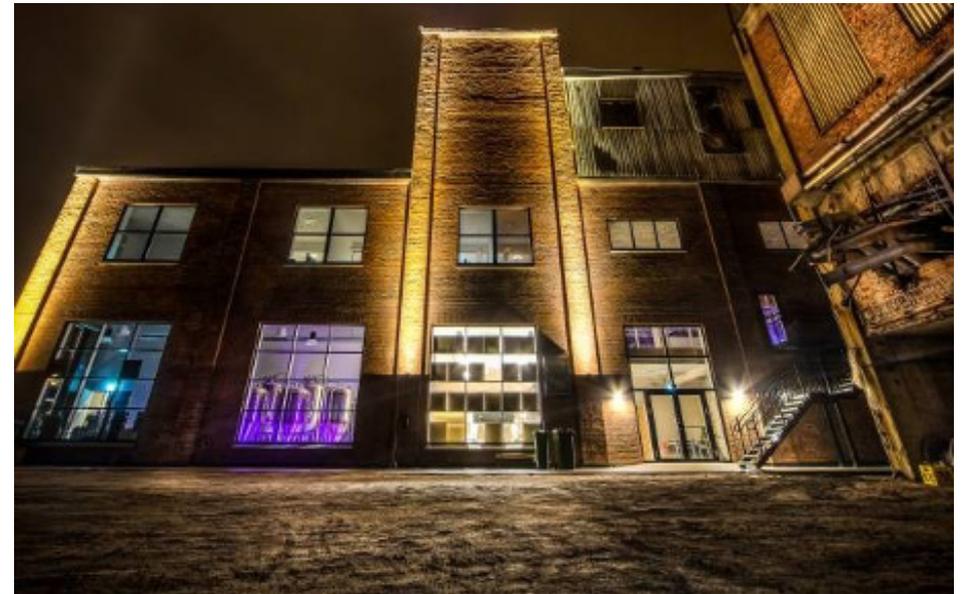
Technical Tour (changed to digital)



The registered participants are welcome to the guided tour through the facilities of Mechatronics Innovation Lab (MIL) on Wednesday afternoon, 22 April. The bus will take the participants from Campus Kristiansand and, afterwards, bring you back while also stopping at the AMC2020 conference hotels.

MIL is a technology catapult for innovation, piloting and technology qualification within mechatronics and related areas. It offers access to technologies, competence and connection to a broad network of partners.

Cultural Tour (initial, substituted by Virtual Tour)



The registered participants are welcome to a guided tour at Hunsfos Business Park followed by a historical view of Hunsfos Factories and beer tasting at the Hunsfos Brewery in Vennesla on Wednesday afternoon, 22 April. The bus will take the participants from Campus Kristiansand and, afterwards, bring you back while also stopping at the AMC2020 conference hotels.



“Beer tasting with a touch of history” – behind the old walls of Hunsfos Paper Factory participants are invited to taste various local beer with a sense of the old atmosphere.

AMC 2020

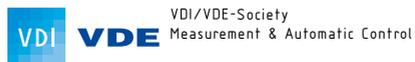
IEEE 16th International Workshop
on Advanced Motion Control



Sponsors:



Technical co-sponsors



amc2020-contact@ieee.org