Ⅱ. Conference Organization

A. International Advisory Council

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Exhibition Chair : Tae-Hyoung Kim (Chung-Ang Univ., Korea)

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Koichi Osuka (Osaka Univ., Japan)

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Chung Choo Chung (Hanyang Univ., Korea)
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Seong Youb Chung
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Zhengtao Ding
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Shuichi Nishio (ATR, Japan)
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Ju H. Park (Yeongnam Univ., Korea)
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Zhaowu Ping (Hefei Univ. of Tech., China)
Gade Pandu Rangaiah
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Won-jong Kim (Texas A&M Univ., USA)
Youngbok Kim (Pukyong Natl. Univ., Korea)
Yosuke Kinoe (Hosei Univ., Japan)
Mathukumail Vidyasagar
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Sheng-Guo Wang (UNC at Charlotte, USA)
Keigo Watanabe (Okayama Univ., Japan)
Hyun Soo Woo (KIMM, Korea)
Yoshiyuki Yamashita (TUAT, Japan)
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(Catholic Univ. of Daegu, Korea)
Woon Jong Yoon (Qatar University, Qatar)

III. Conference Information

A. Financial Sponsors

Companies and organizations listed below contributed financial support for the ICCAS 2014.

Korean Federation of Sci. and Tech. Societies	POSCO
Gyeonggi Tourism Organization	Samsung Heavy Industries Co., Ltd.
Korea Tourism Organization	POSCO ICT
Chonnam National Univ., Robot Research Initiative	LS Industrial System Co., Ltd.
Bio-Mimetic Robot Research Center	Intelligent Vehicle IT Research Center

B. Technical Program Overview

The technical program of the ICCAS 2014 consists of 39 sessions with 337 papers contributed by the authors from 25 countries. They are selected for the final program from the 387 submissions. The conference is highlighted with 6 plenary lectures: "New Horizon for Signal Processing: What Control Can Contribute" by Prof. Yutaka Yamamoto, "Synchronization, Intervention and Distributed Estimation" by Prof. Lei Guo, "Wearable Robots: Challenges in Human-Machine Integration and Control" by Prof. H. Harry Asada, "Industry 4.0: Challenges and Opportunities for Optimization-based Control" by Prof. Frank Allgöwer, "New Developments on Lower Extremity Exoskeleton Systems" by Prof. Homayoon Kazerooni, and "Collaboration of Multiple UAVs for Transportation: Modeling and Control Design" by Prof. Min-Jea Tahk.
Welcome Reception will be held on Wednesday, October 22 at the Room 204. Conference Banquet will be held on Friday, October 24 with celebration of the 20th Anniversary of ICROS in the 2nd-floor Grand Ball Room of MVL hotel.

The proceedings will be distributed in USBs and will be indexed in the IEEE Xplore, SCOPUS, and EI compendex.

C. Registration

All the conference attendees must register. If you have registered in advance, you can pick up your conference materials at the conference registration desk (2nd Floor Lobby). The registration desk will be opened from 9:30 am to 6:00 pm on Oct. 20 and from 8:30 am to 6:00 pm on Oct. 22~24.

Conference registration includes USB Proceedings, Final Program & Digest Book, Lunch Tickets, Welcome Reception, and Conference Banquet. Accompanying persons who wish to attend the banquet should purchase tickets (KRW 70,000) at the registration desk.

D. Conference Logistics

A beam projector and a laptop computer will be provided in the presentation rooms of all the technical sessions, workshops, and tutorials. The technical program of the ICCAS 2014 is organized in 6 parallel tracks of sessions. The session rooms are located close to each other. All the parallel sessions are synchronized, allowing convenient switching between tracks. The session chairs and the speakers are requested to adhere to the timetable.

E. Social Programs and Events

Opening Ceremony
- Date & Time: October 22 (WED), 11:00~11:10
- Place: Room 204

Welcome Reception
- Date & Time: October 22 (WED), 18:00~19:30
- Place: Room 204
- Fee: Free (included in both full and student registration)

Conference Banquet
- Date & Time: October 24 (FRI), 18:30~20:30
- Place: MVL hotel (2nd floor Grand Ball Room)
- Fee: Free (included in both full and student registration)

Lunch
The lunch tickets can be used at the Food Court on the 2nd floor.

Coffee and Refreshments
Coffee and refreshments will be served during the interactive poster session in the Room 212 & 213.

F. Exhibition

Gaitech International Ltd.
Website: www.gaitech.hk
Gaitech is integrating, distributing, manufacturing and supporting a wide range of cutting edge robotics products based on ROS.
Exhibit items: Research, industrial and educational Robot

Springer
Website: www.springer.com
Springer is a global publisher.
Exhibit items: books and journals

Ⅳ. Local Information

A. Gyeonggi-do (Gyeonggi Province)

Located in the mid-western part of Korea, Gyeonggi-do embraces Seoul and Incheon. It offers a variety of beautiful tourist destinations and cultural attractions along the Hangang River. Gyeonggi-do is also proud to embody traditional Korean culture with such places as Suwon Hwaseong Fortress, Korean Folk Village and Icheon Pottery Village, Everland, an exciting amusement park is also located in Gyeonggi-do..

B. Local Information

Passport and Visa

All the visitors to the Republic of Korea must have a valid passport and visa. Visitors with round trip transportation tickets from the countries that have a special agreement with Korea may be exempted from the visa requirement, and can stay in Korea Visa-free for periods up to thirty days, or ninety days, depending on the type of agreement between the two countries. For more information, please contact the local Korean Consulate or Embassy in your country, or refer to the web-site www.korea.net or www.moj.go.kr.

Electricity

Korea uses 220-Volt, 60-Hz systems.

Climate

Gyeonggi-do has four distinctive seasons. October is in the middle of Autumn. The average daytime temperature in Gyeonggi-do during the conference will be around 15°C. We recommend light jackets for late night and early morning.

Currency

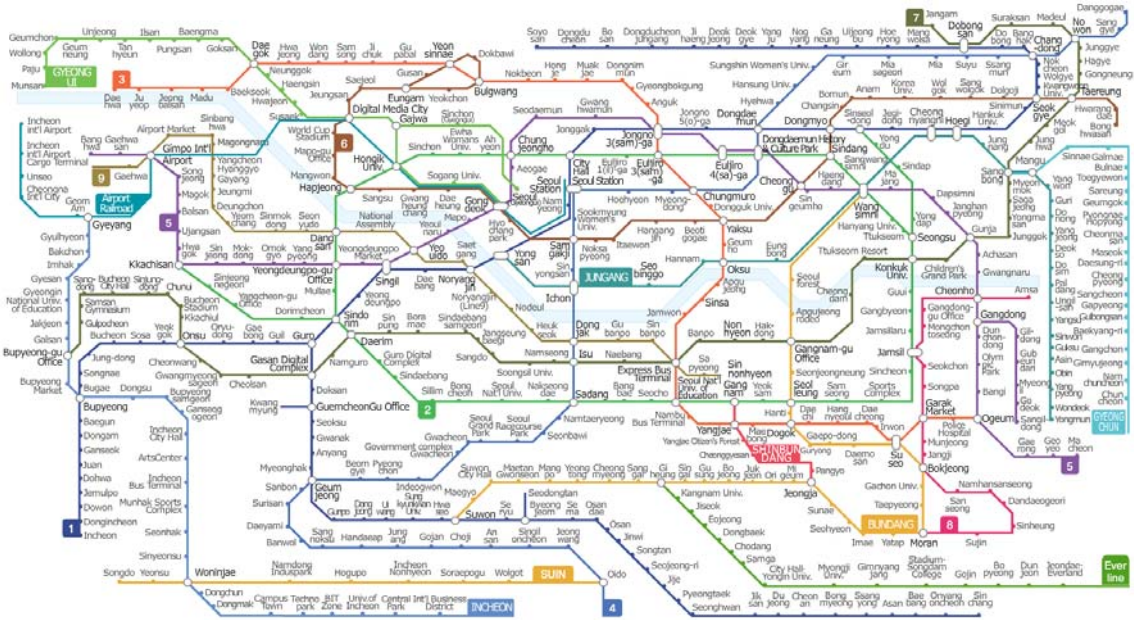
The unit of currency of Korea is Won. Notes include 1,000, 5,000, 10,000, and 50,000 Won denominations. Coins include 10, 50, 100, and 500 Won denominations.

Time Zone

Korean Time Zone is plus 9 hours to the Greenwich Mean Time.

C. Transportation

Subway: the conference venue is at 10 min walk from Daehwa Station (Line 3 → Exit 1 or 2)



V. Tutorials

A. Sliding Mode Control and Observation

- Date & Time : October 21 (TUE) 10:00-17:30
- Room : 206A
- Organizer : Intelligent Vehicle IT Research Center, Seoul Nat'l Univ.
- Fee : Student 150 USD, Regular 200 USD
- Language : English
- Program :

The sliding mode methodology has been proved to be effective in dealing with complex dynamical systems affected by disturbances, uncertainties and un-modelled dynamics. Robust controllers can be developed exploiting the well known insensitivity properties of sliding modes to so-called matched uncertainties. These robustness properties have also been exploited in the development of nonlinear observers for state and unknown input estimation.

The workshop will begin with an introduction to conventional sliding and will then go on to examine more recent developments – so-called higher-order sliding modes, particularly second-order sliding modes. Throughout the workshop a number of practical engineering examples will be considered to demonstrate the features and advantages of using sliding modes. The results of implementations of these ideas will be presented and discussed. In addition, a detailed case study will be presented demonstrating the use of sliding mode ideas for fault detection and fault tolerant control in aerospace systems.

Instructor: Christopher Edwards (University of Exeter, United Kingdom)

• 10:00 - 11:00 an overview of sliding modes and their properties
• 11:00 - 12:00 conventional sliding mode controllers and their design (+case study)
• 12:00 - 13:30 Lunch
• 13:30 - 14:30 conventional sliding mode observers and their properties
• 14:30 - 16:00 second-order sliding mode controllers/observers/differentiators
• 16:00 - 17:30 sliding modes for fault detection and fault tolerant control (an aerospace case study)

B. Introduction to Filtering Theory with Applications to Autonomous Ground Vehicle

- Date & Time : October 21 (TUE) 10:00-17:30
- Room : 207
- Organizer : Chan Gook Park (Seoul National University)
- Fee : Student 150,000 Won, Regular 200,000 Won
- Language : Korean
- Program

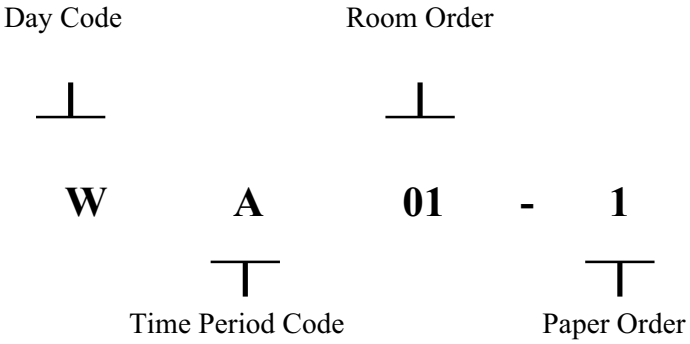
The principal goal of this tutorial is to provide an introduction to the basic principle and applications of Linear Kalman filter, Unscented Kalman filter and Particle filter to autonomous ground vehicles. Fundamental concept on the filtering techniques with detailed mathematical development will be introduced, so that one can build up solid background on the basics of Kalman filter as well as general estimation theory. Considering the importance of Kalman filtering in the practicing areas of autonomous ground vehicle, practical applications of Kalman filter in real fields are also presented following the basic theory.

The workshop will deliver highly useful knowledge and experience for graduate students working on related research, scientists of government institutes, and field engineers being involved with practical projects. The one-day tutorial consists of three parts. In the morning session, introduction and mathematical developments of the linear Kalman filter theory is scheduled. During the afternoon session, more advanced filters such as the unscented filter and the particle filters will be discussed. Finally, filtering techniques for perception, decision, and control based on vision sensor, Radar, and Lidar will be explained to improve safety and convenience of autonomous ground vehicle applications.

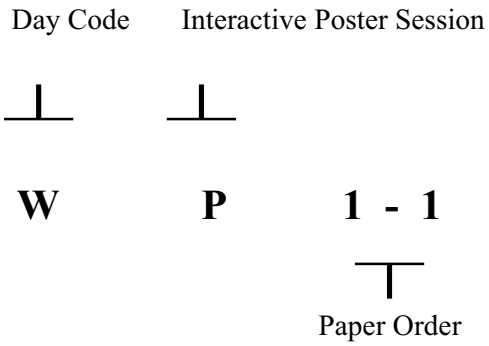
• 10:00 – 12:00: Lecture 1 (Linear Kalman Filters) – Ick Ho Whang (ADD)
• 12:00 – 13:30: Lunch
• 13:30 – 15:30: Lecture 2 (Nonlinear Filters) – Seong Yun Cho (Kyung-Il University)
• 15:30 – 17:30: Lecture 3 (Filtering for Applications to Autonomous Driving) – Kyongsu Yi (SNU)

VI. Paper Identification Number

A. Lecture Sessions:

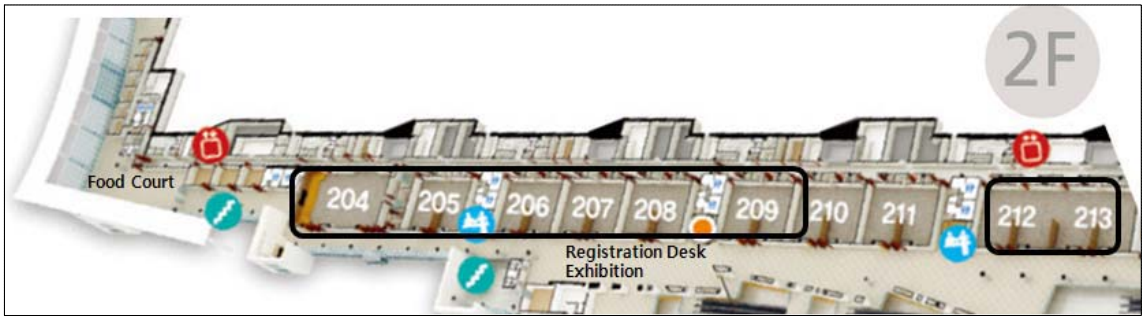


B. Interactive Poster Sessions:



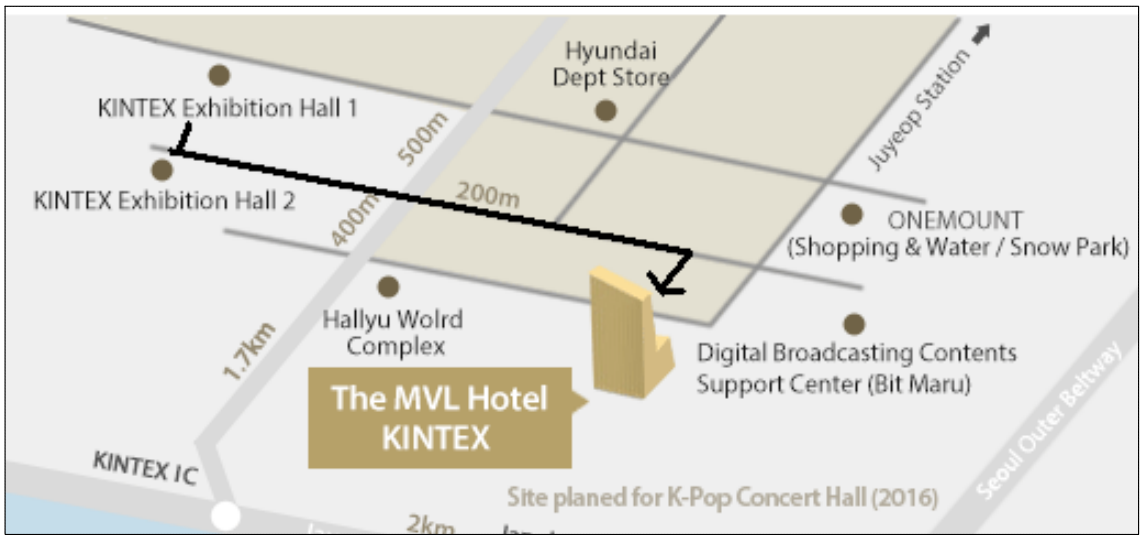
Day Code	Time Period Code
W - Wednesday **T -** Thursday **F -** Friday	**A**- 09:10~10:40 **B**- 13:30~15:00 **P**- 16:30~18:00

VII. Floor Plan: KINTEX Exhibition Center Ⅰ



Registration Desk & Exhibition (Lobby),
Opening Ceremony & Plenary Lectures & Welcome Reception (204),
Headquarters (209A),
Interactive Poster Session & Coffee Services (212 & 213),
Lecture Sessions: Room 01 (206A), Room 02 (206B), Room 03 (207A),
Room 04 (207B), Room 05 (208A), Room 06 (208B),
Lunch (Food Court)

Conference Banquet : MVL Hotel (2F Grand Ball Room)



VIII. Program Schedule and Session Timetable

A. Program Schedule

	10.22(WED)	10.23(THU)	10.24(FRI)	10.25(SAT)
08:30-18:00	Registration			
09:10-10:40	Session A	Session A	Session A	Robot World Exhibition Tour
11:00-12:00	**Opening Ceremony & Plenary Lecture I**	**Plenary Lecture III**	**Plenary Lecture V**	
12:00-13:30	Lunch	Lunch	Lunch	
13:30-15:00	Session B	Session B	Session B	
15:20-16:20	**Plenary Lecture II**	**Plenary Lecture IV**	**Plenary Lecture VI**	
16:30-18:00	Interactive Poster Session	Interactive Poster Session	Interactive Poster Session	
18:00-19:30	Welcome Reception		Conference Banquet (18:30-20:30)	

* The Technical Tutorials are on Tuesday, October 21.

B. Session Timetable

Room	206A	206B	207A	207B	208A	208B
October 21 (Tuesday)						
10:00~12:00 13:30~17:30	Full Day Tutorial I: Sliding Mode Control and Observation		Full Day Tutorial II: Introduction to Filtering Theory with Applications to Autonomous Ground Vehicle			
October 22 (Wednesday)						
09:10~10:40	WA01 Nonlinear Systems and Control	WA02 Manufacturing Systems	WA03 Perception and Recognition	WA04 SICE-ICROS Joint Session: Model-based Control and Its Application	WA05 Machine Vision and Applications	WA06 Basics on Glocal Control: Concept, Fundamental Theory, and Applications to Energy Management Systems
11:00~12:00	Plenary Lecture I (Room 204): New Horizon for Signal Processing - What Control Can Contribute Yutaka Yamamoto					
13:30~15:00	WB01 Disturbance Rejection and Attenuation	WB02 Aerospace Control	WB03 Mechanism and Manipulation	WB04 SICE-ICROS Joint Session: Modeling and Parameter Tuning based Control	WB05 Recent Advances in Brain-Machine Interface	WB06 How to give a GOOD presentation?
15:20~16:20	Plenary Lecture II (Room 204): Synchronization, Intervention and Distributed Estimation Lei Guo					
16:30~18:00	Interactive Poster Session [WP] (Room 212 & 213)					
18:00~19:30	Welcome Reception (Room 204)					
October 23 (Thursday)						
09:10~10:40	TA01 Intelligent Systems	TA02 Communication and Signal Processing	TA03 Human-Robot Interaction	TA04 SICE-ICROS Joint Session: Service Robot Technology and Its Application in Various Fields	TA05 Autonomous Navigation and Control Technology applied to Military Unmanned Ground Vehicles/Robots	TA06 Basics on Differential-Algebraic Equations (DAEs)
11:00~12:00	Plenary Lecture III (Room 204): Wearable Robots: Challenges in Human-Machine Integration and Control H. Harry Asada					
13:30~15:00	TB01 Control Applications	TB02 Automotive Control	TB03 Motion Planning and Control	TB04 SICE-ICROS Joint Session: Service Robot Technology and Its Application in Medical Field	TB05 Sensing and Behavior Control of Robot-Assisted Systems	TB06 Autonomous Multi-UAV Systems
15:20~16:20	Plenary Lecture IV (Room 204): Industry 4.0: Challenges and Opportunities for optimization-based Control Frank Allgöwer					
16:30~18:00	Interactive Poster Session [TP] (Room 212 & 213)					
October 24 (Friday)						
09:10~10:40	FA01 Identification, Estimation, and Observers	FA02 Controls for Energy Systems	FA03 Control of Multi-modal Robots	FA04 Disturbance Observers in Control Engineering	FA05 Electric Vehicle Control	FA06 Basics on Collaborative Filtering and Recommendation System
11:00~12:00	Plenary Lecture V (Room 204): New Developments on Lower Extremity Exoskeleton Systems Homayoon Kazerooni					
13:30~15:00	FB01 Robust Control	FB02 Bio-systems and Process Control	FB03 Robot Systems Control	FB04 Statistical Inference and Data Mining	FB05 Measurement, Control, and Systems in the Steel Industry	FB06 Meet the Expert: Prof. Kazerooni
15:20~16:20	Plenary Lecture VI (Room 204): Collaboration of Multiple UAVs for Transportation: Modeling and Control Design Min-Jea Tahk					
16:30~18:00	Interactive Poster Session [FP] (Room 212 & 213)					
18:30~20:30	Conference Banquet (MVL Hotel, 2F Grand Ball Room)					
October 25 (Saturday)						
10:00~17:00	Robot World Exhibition Tour					

Ⅸ. Plenary Lectures

A. Plenary Lecture I

(Chair: Songhwai Oh)

October 22 (WED), 11:00~12:00, Room 204

Yutaka Yamamoto
Professor, Dept. of Applied Analysis and Complex Dynamical Systems, Kyoto University, Japan

New Horizon for Signal Processing - What Control Can Contribute

Abstract: There has been remarkable progress in sampled-data control theory in the last two decades. The main achievement here is that there exists a digital (discrete-time) control law that takes the intersample behavior into account and makes the overall analog (continuous-time) performance optimal, in the sense of H-infinity norm. This naturally suggests its application to digital signal processing where the same hybrid nature of analog and digital is always prevalent. A crucial observation here is that the perfect band-limiting hypothesis, widely accepted in signal processing, is often inadequate for many practical situations. In practice, the original analog signals (sounds, images, etc.) are neither fully band-limited nor even close to be band-limited in the current processing standards.

The present talk describes how sampled-data control theory can be applied to reconstruct the lost high-frequency components beyond the so-called Nyquist frequency, and how this new method can surpass the existing signal processing paradigm. We will also review some concrete examples for sound processing, recovery of high frequency components for MP3/AAC compressed audio signals, and super resolution for image (still/moving) processing. We will also review some crucial steps in leading this technology to the commercial success of 40 million sound processing chips.

Biography: Yutaka Yamamoto received his B. S. and M. S. degrees in engineering from Kyoto University, Kyoto, Japan in 1972 and 1974, respectively, and the M. S. and Ph. D. degrees in mathematics from the University of Florida, in 1976 and 1978, respectively. From 1978 to 1987 he was with Department of Applied Mathematics and Physics, Kyoto University. In 1987 he joined the Department of Applied Systems Science as an Associate Professor, and became a professor in 1997. He is currently a professor at the Department of Applied Analysis and Complex Dynamical Systems, Graduate School of Informatics of Kyoto University.

His research and teaching interests are in realization and robust control of distributed parameter systems, learning control systems, and sampled-data systems, its application to digital signal processing, with emphasis on sound and image processing.

Dr. Yamamoto received Sawaragi memorial paper award in 1985, outstanding paper award of SICE in 1987 and in 1997, the best author award of SICE in 1990 and in 2000, the George S. Axelby Outstanding Paper Award in 1996, and the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology Prizes for Science of Technology in 2007. He received the IEEE Control Systems Society Distinguished Member Award in 2009, and the Transition to Practice Award of the Control Systems Society in 2012, as well as the ISCIE Best Industrial Paper Award in 2009. He is a Fellow of the IFAC, IEEE and SICE. He is past President of the IEEE Control Systems Society. He served as vice President for Technical Activities of the CSS for 2005-2006, and as vice President for

Publication Activities for 2007-2008. He served as an associate editor of the IEEE Transactions on Automatic Control, Automatica, Systems and Control Letters, and Mathematics of Control, Signals and Systems. He has served as a Senior Editor for the IEEE Transactions on Automatic Control for 2010-2011. He also served as an organizing committee member of 35th CDC in 1996, MTNS '91 in Kobe, and as a member of program committees of several CDC's. He was the chair of the Steering Committee of MTNS, served as General Chair of MTNS 2006. He was a past President of ISCIE of Japan.

B. Plenary Lecture Ⅱ

(Chair: Hyo-Sung Ahn)

October 22 (WED), 15:20~16:20, Room 204

Lei Guo
Professor, Institute of Systems Science,
Chinese Academy of Sciences, China

Synchronization, Intervention and Distributed Estimation

Abstract: A fundamental issue in complex systems theory is to understand how locally interacting agents (or particles) leads to global behaviors (or structures) of the systems. Such problems arise naturally from diverse fields ranging from material and life sciences to social and engineering systems, and have attracted much research attention in recent years. In this lecture, we will first consider synchronization problem of a basic class of non-equillibrium multi-agent systems (or flocks) with local interactions, and show how the required connectivity can be established and how small the interactions radius can be in order to ensure synchronization. Then, we will show how the global behaviors of the flocks may be intervened by using the "soft control" idea, without changing the existing interaction rules of the agents. Finally, we will consider estimation problems of time-varying parameters or adaptive filtering problems, and will show how locally or partially interacting estimators will reached consensus for the estimation problem, which cannot be accomplished by any single estimator due to lack of information. Our results will be established based on analyses of the nonlinear dynamical equations involved and of the asymptotical properties of the spectrum of random geometric graphs.

Biography: Lei GUO received his B.S. degree in mathematics from Shandong University in 1982, and Ph.D. degree in control theory from the Chinese Academy of Sciences (CAS) in 1987. He was a postdoctoral fellow at the Australian National University (1987-1989). Since 1992, he has been a Professor of the Institute of Systems Science at CAS. He has been the President of the Academy of Mathematics and Systems Science, CAS (2003-2012), and is currently the Director of the National Center for Mathematics and Interdisciplinary Sciences, CAS.

Dr. Guo is a Fellow of IEEE, Member of the Chinese Academy of Sciences, Fellow of the Academy of Sciences for the Developing World (TWAS), Foreign Member of the Royal Swedish Academy of Engineering Sciences, and Fellow of IFAC. He has served as a Council Member of IFAC, Member of IEEE Control Systems Award Committee, Associate Editor of SIAM J. Control and Optimization and Systems and Control Letters, General Co-Chair of the

48th IEEE-CDC, and Vice-Presidents of both Chinese Mathematical Society and Chinese Association of Automation. Currently, he serves as the President of the China Society for Industrial and Applied Mathematics (CSIAM), Congress Director of the 8th International Congress on Industrial and Applied Mathematics, an IEEE CSS Distinguished Lecturer, and on the editorial boards of a number of journals in mathematics, systems and control.

He has worked on problems in adaptive control, system identification, adaptive signal processing, and time series analysis. His current research interests include the capability of feedback, multi-agent systems, complex adaptive systems, and quantum control systems, among others.

C. Plenary Lecture Ⅲ

(Chair: Kyujin Cho)

October 23 (THU), 11:00~12:00, Room 204

H. Harry Asada
Ford Professor of Engineering, Dept. of Mechanical Engineering,
Massachusetts Institute of Technology, USA

Wearable Robots: Challenges in Human-Machine Integration and Control

Abstract: Imagine that one day, you have a third arm and a third leg attached to your body. The extra limbs will help you hold objects, support your body, share a workload, and streamline the execution of a task. If the movements of such extra limbs, called Supernumerary Robotic Limbs (SRL), are tightly coordinated with your own arms, you may come to perceive the extra limbs as an extension of your body, incorporated into your body image. The objective of this talk is to address technical challenges for transforming robots to act as parts of a human body. Wearable SRLs are opening up new horizons of robotics, posing diverse research issues and challenges ranging from machine design and human-robot coordination, to biomechanics, motor control, and machine learning and perception.

Three types of Supernumerary Robotic Limbs being built at the d'Arbeloff Lab of MIT will be presented: 1) a lightweight robot sitting on the shoulder of a human for lifting and supporting objects in the overhead area, 2) a seven-fingered hand (5 fingers + 2 robotic fingers) for grasping and manipulating large/odd-shaped objects, and 3) a pair of wearable canes attached around the waist for supporting and bracing the human body. For these wearable robots, communication and coordination with the human is the key challenge. Three aspects of coordination control will be presented. First, the concept of biological synergies is applied to the seven-fingered hand in order to control the two robotic fingers in concert with the five human fingers. Through grasp experiments and data analysis using Principal Component Analysis it will be shown that synergies exist for seven-fingered hands as well as for five-fingered hands. For real-time control, Partial Least Squares (PLS) regression is used for extracting control laws from the data that can best correlate the posture of the two robotic fingers to that of the five human fingers. Second, interactive human-robot-task processes are modeled as a concurrent, distributed event system based on Coloured Petri Net (CPN). A type of hybrid control system is constructed by replacing CPN's static state transitions with dynamic, proactive transition laws learned from human demonstration data. Finally, a learning algorithm inspired by biological muscle training is applied to the wearable canes. Untrained robotic actuators are treated as un-innervated muscles. Repeated exposures to simultaneous

physical and informational stimulations lead to formation of artificial neuromuscular junctions that control the wearable robots. The seminar will be concluded with potentials of wearable SRLs and their social and economic impacts, ranging from increasing productivity and safety for factory, construction, and field workers to improved quality of life for elderly people and the handicapped as well as reduced workload for caregivers and clinicians.

Biography: H. Harry Asada is Ford Professor of Mechanical Engineering and Director of the Brit and Alex d'Arbeloff Laboratory for Information Systems and Technology in the Department of Mechanical Engineering, Massachusetts Institute of Technology (MIT), Cambridge, MA. He received the B.S., M.S., and Ph.D. degrees in precision engineering in 1973, 1975, and 1979, respectively, all from Kyoto University, Japan. He specializes in robotics, biological engineering, and system dynamics and control. His current robotics research includes wearable robots, cellular PZT actuators, and robot applications to aircraft manufacturing and nuclear power plant monitoring. His research in the bio area focuses on bio-integrated robots, where live cells and tissues are used as components. He received Best Paper Awards at the IEEE International Conference on Robotics and Automation in 1993, 1997, 1999, and 2010, the O. Hugo Schuck Best Paper Award from the American Control Council in 1985, Best Journal Paper Awards from the Society of Instrument and Control Engineers in 1979, 1984, and 1990, and the Best Journal Paper Award from the Journal of Advanced Robotics in 2002. He was the recipient of the Henry Paynter Outstanding Researcher Award from ASME Dynamic Systems and Control in 1998. More recently he received the 2011 Rufus Oldenburger Medal from ASME, and Ruth and Joel Spira Award for Distinguished Teaching from the School of Engineering, MIT. Dr. Asada is a Fellow of ASME.

D. Plenary Lecture Ⅳ

(Chair: Jung-Su Kim)

October 23 (THU), 15:20~16:20, Room 204

Frank Allgöwer
Professor, Institute for Systems Theory and Automatic Control,
University of Stuttgart, Germany

Industry 4.0: Challenges and Opportunities for optimization-based Control

Abstract: With the vision of the Smart Factory of the future, the manufacturing industries are currently undergoing a fundamental new orientation on the basis of the Cyber-Physical Systems and Internet of Things and Services paradigms. All parts along the manufacturing chain are nowadays equipped with embedded computing, communication and networking capabilities and are expected to interact in an optimal way towards the goal of an energy and resource efficient, save and reliable production process. Through decentralized optimal decision-making and an appropriate communication among the networked individual parts, the whole production process of the future is expected to operate optimally.

In this presentation an introduction to the goals and principles of Industry 4.0 is given and its challenges and opportunities for the field of automatic control are discussed. We will in particular investigate the potential impact of the field of optimization-based control for the fourth industrial revolution and will present two promising approaches, namely economic model predictive control and distributed, cooperative optimization and control.

Economic model predictive control (MPC) is a control technique which is based on the repeated online solution of an optimal control problem. Contrary to classical MPC, the employed cost function can be some general performance measure, possibly connected to the economics of the considered process. This allows to also consider control objectives different from the classical ones of stabilization or tracking, which makes economic MPC well suited as a tool to achieve the goals of Industry 4.0. In this talk, we examine conditions to classify the optimal operational regime for a system, and propose economic MPC schemes which allow for closed-loop average performance guarantees and satisfaction of (standard pointwise-in-time as well as averaged) constraints.

For the visions of Industry 4.0 to become reality, tools and methods are required to handle control and decision problems in a distributed and networked fashion. Relating to ideas such as the Internet of Things, distributed optimization algorithms, that work within asynchronous communication networks, are becoming more and more relevant. We present in this talk a broad framework for distributed optimization, in asynchronous peer-to-peer networks. Our framework is based on polyhedral approximations, and lends itself into a variety of distributed algorithms for solving specific decision problem, that are relevant in the context of Industry 4.0. We show how from the general framework algorithms can be derived to solve, e.g., assignment problems or robust optimization problems. Furthermore, we show that the general optimization framework leads naturally to a distributed model predictive control scheme, that is based on the exchange of predicted systems trajectories.

Biography: Frank Allgöwer is director of the Institute for Systems Theory and Automatic Control and full professor in Mechanical Engineering at the University of Stuttgart in Germany. Frank's main interests in research and teaching are in the area of systems and control with emphasis on the development of new methods for optimization-based control, networks of systems and systems biology.

Frank received several recognitions for his work including the IFAC Outstanding Service Award, the State Teaching Award of the state of Baden-Württemberg, the Leibniz Prize of the Deutsche Forschungsgemeinschaft and several best paper awards.

At present Frank serves as IEEE CSS Vice-President for Technical Activities and is President-elect of the International Federation of Automatic Control. He is Editor for the journal Automatica and for the Springer Lecture Notes in Control and Information Science book series and serves as Associate Editor or on the editorial board of several further journals. Frank has been organizer or co-organizer of more than a dozen international conferences and has published over 200 scientific articles. Since 2012 Frank serves a Vice-President of the German Research Foundation (DFG).

E. Plenary Lecture Ⅴ

(Chair: Kyoungchul Kong)

October 24 (FRI), 11:00~12:00, Room 204

Homayoon Kazerooni
Professor, Department of Mechanical Engineering,
University of California at Berkeley
Founder, Ekso Bionics

New Developments on Lower Extremity Exoskeleton Systems

Abstract: Our objective at Berkeley is to create a set of advanced technologies that form the framework for developing accessible exoskeleton systems for people with mobility disorders. Our research work is not about creating "walking" capability only; it is about fostering "independence". In addition to walking, there are many maneuvers a person with limited mobility needs to carry out for independence at home and work during a day. For widespread use, exoskeletons must be accessible. The medical wearable robotic exoskeletons allow people with paraplegia or other mobility disorders to be upright and mobile, preventing secondary diseases and enhancing their quality of life. These systems will be used for in-home care and everyday use, as well as within hospitals and rehabilitation centers. The industrial wearable robotic systems minimize spinal compression forces of workers who repeat various maneuvers on the job. These devices will be used in auto assembly plants, factories, manufacturing facilities, distribution centers, warehouses, and delivery services. These systems decrease the severity and number of work-related injuries, while enhancing worker safety. The quest to develop accessible exoskeleton orthotic systems suggests less hardware while placing more emphasis on the intelligence and cleverness during both the design stage and the device operation. This talk will describe new engineering developments to realize accessible exoskeleton systems.

Biography: Dr. Kazerooni is a Professor in the Mechanical Engineering Department at the University of California, Berkeley and director of the Berkeley Robotics and Human Engineering Laboratory. The laboratory's mission is to develop fundamental scientific and engineering principles on robotics, control sciences, exoskeletons, and bioengineering. Dr. Kazerooni is also the founder of Ekso Bionics. Most of the developed technologies in this lab have found their ways to market. Prior to his research work on lower extremity exoskeletons, Dr. Kazerooni led his team to successfully develop robotics systems that enhance human upper extremity strength. The results of this work led to a new class of intelligent assist devices currently being used by workers worldwide for manipulating heavy objects in distribution centers and factories. Dr. Kazerooni holds a Doctorate in Mechanical Engineering from MIT and has published more than two hundred articles, delivered over 100 plenary lectures in the U.S. and internationally, and holds numerous pertinent patents and awards. As a noted authority on robotics, he is frequently profiled and quoted in the media. More information can be obtained in http://en.wikipedia.org/wiki/Homayoon_Kazerooni

F. Plenary Lecture Ⅵ

(Chair: Toru Namerikawa)

October 24(FRI), 2014 (15:20~16:20), Room 204

Min-Jea Tahk
Professor, Department of Aerospace Engineering,
KAIST, Korea

Collaboration of Multiple UAVs for Transportation: Modeling and Control Design

Abstract: Recently, numerous studies on small unmanned aerial vehicles (UAVs) are conducted with various practical usages. Transportation of a payload is one of the missions that can be implemented in military or civilian operations. In this talk, some important aspects of

modeling and control design of multi-UAV transportation system is discussed.

System dynamic modeling is heavily dependent on the type of the transportation. One option is the string-based transportation called the slung-load transportation, and other method is called the body-contact transportation. For the slung-load transportation, a payload is tied to a set of strings that are connected to each transporting UAV. The major advantage of this method is that the rotational motion of each UAV can be decoupled from the motion of the payload and other UAV's. On the other hand, the body-contact transportation type is to directly attach the body of the UAVs to the payload, so that there is no need for a string. However, the motion of the UAV's is constrained since the UAV's are rigidly attached to the payload.

The equations of motion can be derived by several modeling methods. Specifically, Udwadia-Kalaba Equation (UKE) is very useful in modeling constrained systems such as the slung-load transportation systems. However, obtaining a minimal state-space representation from this approach is not so easy. A Newtonian approach with a judicious choice of coordinates system may be a better strategy.

Recognizing the payload is also an important task. An onboard camera may detect a QR code market attached to the payload to identify the payload and obtain extra information such as the weight of the payload and the location of the grip points. This information helps to determine the required number of UAV's

Variations in payload weight should be considered in control design. Since the slung-load system is a coupled system with different dynamic entities, the system can easily become unstable. Robust controllers such as LQG/LTR and PRLQG(parameter robust LQG) can provide stability and performance robustness. The performance of the controllers can be compared by computer simulation or indoor flight tests. Motion capture systems with multiple cameras are valuable tools for this purpose.

Biography: Dr. Tahk is Professor in Aerospace Engineering at Korea Advanced Institute of Sciene and Technology(KAIST). He received the B.S. degree in aeronautical engineering from Seoul National University in 1976, and the M.S. and Ph.D. degrees in aerospace engineering from the University of Texas at Austin in 1983 and 1986, respectively.

Before he joind KAIST in 1989, he worked for Agency for Defense Development, Daejeon Korea, from 1976 to 1981, and Integrated Systems Inc., Santa Clara CA, USA, from 1987 to 1989. He has served various academic institutes: Vice President of ICROS in 2007-2008 and 2010, President of the Korean Society for Aeronautical & Space Sciences(KSAS) in 2012, and President of Korea Unmanned Vehicle Systems Association(KUVSA) in 2013-2014.

He was also the IPC Co-Chair of the 60th International Astronautical Congress(IAC) held in Dajeon, Korea, in 2009. Now his editorial duties include Technical Editor for Guidance and Control, IEEE Tr. Aerospace and Electronic Systems. His major research area is guidance and control of missile and UAV systems, target tracking and collision avoidance, and parameter optimization techniques. He has published 180 papers in international and domestic journals and presented more than 400 conference papers.

X. Special Sessions

A. Free Tutorial Sessions

If you are registered for the conference, you can attend the special tutorial sessions organized by leading researchers in the fields for free.

Basics on Glocal Control: Concept, Fundamental Theory,
and Applications to Energy Management Systems

- Date & Time : October 22 (WED) 09:10-10:40
- Room : WA06 - 208B

Glocal control means that the global purpose is achieved by only local actions of measurement and control in relatively large-scale dynamical systems such as energy networks, transportation systems, biological systems, and multi-agent dynamical systems. The key for realization of glocal control is hierarchical netwoked dynamical systems with multiple resolutions.

"Glocal Control: Concept, Framework, and Fundamental Theory“
Prof. Shinji Hara (The University of Tokyo, Japan)

"Projective State Observers for Large-Scale Network Systems towards Glocal Predictors"
Prof. Jun-ichi Imura (Tokyo Institute of Technology, Japan)

"Hierarchical Distributed Control for Large-Scale Network Systems:
Algorithm and Application to Pricing of Electric Power Networks"
Prof. Koji Tsumura (The University of Tokyo, Japan).

Basics on Differential-Algebraic Equations (DAEs)

- Date & Time : October 23 (THU) 09:10-10:40
- Room : TA06 – 208B
- Instructor : Prof. Stephan Trenn (Technische Universität Kaiserslautern, Germany).

One common approach to model complicated systems is to decompose the system in simple subsystems which are connected through common variables. Even if the behavior of each subsystem is described by ordinary differential equations (ODEs), the connections between the subsystems introduce algebraic constraints. Hence the overall system is described as a differential-algebraic equation (DAE). This is a fundamental modeling principle, especially when the modeling is carried out automatically. This tutorial will give a brief introduction into the DAE-modeling framework. In particular, major differences to ODEs are highlighted and discussed, for example, over- and underdetermined DAEs, inconsistent initial values and distributional solutions.

Basics on Collaborative Filtering and Recommendation System

- Date & Time : October 24 (FRI) 09:10-10:40
- Room : FA06 – 208B
- Instructor : Prof. Kyomin Jung (Dept. Electrical and Computer Eng., Seoul National University, Korea)

This tutorial presents the underlying concepts of collaborative filtering, including similarity measures and dimensionality reduction, and their applications to recommendation system.

B. Special Sessions for Younger Researchers

How to give a GOOD presentation?

- Date & Time : October 22 (WED) 13:30-15:00
- Room : WB06 – 208B

Prof. Yamamoto (Past President of IEEE Control Systems Society) will illustrate some typical mistakes that should be avoided for a good presentation.

Autonomous Multi-UAV Systems

- Date & Time : October 23 (THU) 13:30-15:00
- Room : TB06 – 208B

This session is to present the up-to-date technology of autonomous systems including unmanned aerial vehicles.

Meet the Expert: Professor Kazerooni

- Date & Time : October 24 (FRI) 13:30-15:00
- Room : FB06 – 208B

One of our plenary speakers, Professor Kazerooni, will meet you in an informal setting. He will give a short exciting presentation, and have informative conversation with the audience.

XI. Conference Awards

A. Outstanding Paper Awards

Award committee of ICCAS 2014 is pleased to announce the winners of Outstanding Paper Awards as listed below. We will celebrate their excellent achievements at the conference banquet. Please join the banquet and congratulate the winners.

- Yasser Mohammad, Toyoaki Nishida (Kyoto University) “Robust Learning from Demonstrations using Multidimensional SAX” (WA03-1)

- Shota Kanno, Sumito Kashihara, Seonghee Jeong (Osaka Electro-Communication University) “Generation of Monitoring Signal in Safety Confirmation Type Contact Sensor using Ultrasonic Wave Propagating in Viscoelastic Tube” (WA03-2)

- Se-Kyu Oh, Jong Min Lee (Seoul National University) “Iterative Learning Control Algorithm for a Class of Discrete LTI System with Batch-varying Reference Trajectories” (WB01-5)

- Christian Nitschke, Yuki Minami, Masayuki Hiromoto, Hiroaki Ohshima, Takashi Sato (Kyoto University) “A Quadrocopter Automatic Control Contest as an Example of Interdisciplinary Design Education” (TB01-4)

- Rui-Jun Yan, Jing Wu, Chao Yuan, Ji-Yeong Lee, Chang-Soo Han (Hanyang University) “Natural Corners-based Two-Dimensional (2D) SLAM with Partial Compatibility Algorithm in Indoor Environment” (TB03-6)

- Kazuhiko Terashima, Takanori Miyoshi, Kenta Itokazu, Yuki Ueno, Daisuke Watanabe (Toyohashi University of Technology) “Modeling and Taylormade Training Method Using Neural Network for Specific Muscle of the Upper Limb” (TB04-1)

- Dong-Kyeong Lee, Minchan Kim, Kiwan Kim, Jiyun Lee (KAIST) “Fast Location Survey of DGNSS Reference Station to Support UAV Navigation” (TB06-1)

- Tomoharu Suehiro, Toru Namerikawa (Keio University) “Hierarchical Control of Power Networks by using Overlapping Information” (FA02-3)

- Youngjun Joo, Gyunghoon Park (Seoul National University) “Reduced Order Type-k Disturbance Observer based on Generalized Q-filter Design Scheme” (FA04-4)

- Minkyu Jeon, Boeun Kim, Mingyu Sung, Jay H. Lee (KAIST) “Integration of the Microalgae DroopModel with the Metabolic Network System for Biodiesel Production” (FP5-4)

B. Student Best Paper Awards

Award committee of ICCAS 2014 is pleased to announce 9 candidates for Student Best Paper Awards as listed below. Four or five winners out of the candidates will be selected based on their presentations, and announced at the conference banquet.

- Shunsuke Hara, Noritaka Sato, Yoshifumi Morita (Nagoya Institute of Technology) “Verification of Usability of Teleoperation System Using Past Image Records by Sharing Information Obtained from External Cameras” (WA03-3)

- Tushar Sandhan, Sukanya Sonowal, Jin Young Choi (Seoul National University) “Audio Bank: A High-Level Acoustic Signal Representation for Audio Event Recognition” (WA03-4)

- Moussa Hamadache, Dongik Lee (Kyungpook National University) “Improving Signal-to-Noise Ratio (SNR) for Inchoate Fault Detection based on Principal Component Analysis (PCA)” (TA02-3)

- Qichang Qi, Yoshie Maeda, Kazunori Yamazaki, Noritaka Sato, Yoshifumi Morita, Hiroyuki Ukai, Kouji Sanaka (Nagoya Institute of Technology) “Improvement of Knee Flexion and Extension Simulation Accuracy in KneeRobo” (TA03-6)

- Suwannee Phayapchaiyakun, Sathit Intajag, Thani Jintasuttisak (Prince of Songkla University) “Spectral Preservation of Pan-sharpening for THEOS imagery” (TB01-5)

- Thani Jintasuttisak, Sathit Intajag (Prince of Songkla University) “Color Retinal Image Enhancement by Rayleigh Contrast-Limited Adaptive Histogram Equalization” (TB01-6)

- Taigi Suzuki, Yuta Hongo, Nobuto Matsuhira (Shibaura Institute of Technology) “Development of an Apparatus for Measuring and Supporting Human Standup Motions” (TB04-3)

- Shota Kajihara, Seiichi Murakami, Hyoungseop Kim, Joo Kooi Tan, Seiji Ishikawa (Kyushu Institute of Technology) “Automatic Segmentation of Phalanges Regions in CR Images Based on MSGVF Snakes” (FB02-1)

- Sung Jin Yoo, Jung Hun Kim, Jong Min Lee (Seoul National University) “Soft sensor design with state estimator for lipid estimation of microalgal photobioreactor system” (FB02-3)