



October 18(**WED**)~21(**SUN**)
 Ramada Plaza, J

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Soft Robotics

- Time: **[FB1] October 20(Fri), 13:10~14:40**
- Room: 2F Ramada Ballroom2
- Organizer: Prof. Kyujin Cho (Seoul National University, Korea)
- Program:
 - 13:10~13:40 | "Smart Wearables for Gesture Recognition and Gait Training" – Peter B. Shull
 - 13:40~14:10 | "Soft Robotics for Locomotion and Manipulation" – Shinichi Hirai
 - 14:10~14:40 | "Soft Artificial Skin Sensors and Muscle Actuators for Future Robots" – Yong-Lae Park



1. Smart Wearables for Gesture Recognition and Gait Training

Peter B. Shull

State Key Laboratory of Mechanical System and Vibration,
 School of Mechanical Engineering, Shanghai Jiao Tong University,
 China

Abstract: Increasingly sophisticated wearable devices are both broadening and deepening the scope of human-computer interaction. This work explores the challenges and potential solutions of smart wearable devices for human gesture recognition and gait training. Novel wrist- and hand-worn devices will be presented showing promise for improving accuracy and robustness for hand gesture recognition. And, a distributed, configurable wearable system will be presented with applications in real-time gait and posture training.

Biography: Peter B. Shull received the Ph.D. degree from Stanford University in Mechanical Engineering in 2012, and is currently an Associate Professor in the Robotics Institute in the School of Mechanical Engineering at Shanghai Jiao Tong University. He has received several awards including the China 1000 Young Talents Award in 2013 and the



2. Soft Robotics for Locomotion and Manipulation

Shinichi Hirai

Department of Robotics, Ritsumeikan University, Japan

Abstract: Introducing soft and deformable materials into robotic systems will bring novel functions. This presentation shows robotic locomotion and manipulation performed through soft and deformable materials. First, we show soft robots capable of rough terrain locomotion by their rolling and jumping. A robot consisting of deformable soft body and flexible actuators can roll and jump on a ground by the deformation of its deformable body. We demonstrate the rolling and jumping of soft robots with mechanical analysis of their behavior. Second, we show robotic hands with soft materials for soft object manipulation. Soft objects such as clothes and food have much variation in their shapes, implying that robotic hands for soft objects have to cope with such variation. Soft robotic hands are able to cope with such shape variation. We show binding hands, which use elastic threads for grasping, and printable hands, which consist of pneumatically driven rubber fingers. Both hands are applied to food material handling.



Biography: Shinichi Hirai received his B.S., M.S., and Doctoral degrees in applied mathematics and physics from Kyoto University in 1985, 1987, and 1991, respectively. He is currently a Professor in the Department of Robotics at Ritsumeikan University. He was a Visiting Researcher at Massachusetts Institute of Technology in 1989 and was an Assistant Professor at Osaka University from 1990 to 1996. His current research interests are soft robotic hands, soft sensors, soft object manipulation, and soft object modeling. He received SICE (Society of Instrument and Control Engineers) Best Paper Award at 1990, the finalist of Automation Best Paper Award at 2001 IEEE ICRA, the finalist of Manipulation Best Paper Award at 2005 and 2006 IEEE ICRA, the finalist of Vision Best Paper Award at 2006 IEEE ICRA, RSJ (Robotics Society of Japan) Best Paper Award at 2008, the finalist of 2011 IEEE ROBIO Best Paper in Robotics, and FOOMA Japan 2017 Academic Plaza Award Grand Prix. He is serving as an Associate Editor of IEEE Transactions on Robotics from 2014. He is a member of IEEE, RSJ, JSME, and SICE.



Abstract: Innovation in soft sensor and actuator technologies is extremely important for future robots for increased human-safety and human-robot interaction. This talk will describe the design and manufacturing processes for developing biologically inspired soft robots, including: i) hyperelastic artificial skin sensors with multi-modal sensing capability; ii) smart pneumatic artificial muscle actuators inspired by biological muscles; and iii) soft robots inspired by soft sensors and actuators as application systems. The talk will

also discuss novel manufacturing technologies for building multi-material, multi-functional, Department of Mechanical Engineering, Seoul National University, Korea

Department of Mechanical Engineering, Seoul National University, Korea

Biography: Yong-Lae Park is an Assistant Professor in the Department of Mechanical and Aerospace Engineering at Seoul National University (2016-present). Prof. Park completed his Ph.D. degree in Mechanical Engineering from Stanford University (2010), conducted postdoctoral research in the Wyss Institute for Biologically Inspired Engineering at Harvard University (2010-2013), and was an assistant professor in the Robotics Institute at Carnegie Mellon University (2013-2016). His current research interests include artificial skins and muscles, soft robots, wearable devices and robots, and smart structures and materials. He is the winner of Okawa Foundation Research Grant Award, in 2014, the Best Paper Award from the IEEE Sensors Journal, in 2013, a NASA Tech Brief Award from the NASA Johnson Space Center, in 2012, and a Technology Development Fellowship for independent postdoctoral research from the Wyss Institute at Harvard University, in 2010. His recent paper on soft artificial skin was selected as a cover article of the IEEE Sensors Journal, and his work on soft artificial skin and soft robots were recently featured in Nature, Discovery News, New Scientist, engadget, PBS NOVA, and Reuters.

Recent Advances on Nonlinear Control and Its Applications

- Time: **[WB6, WC6] October 18(Wed) 13:10~14:40, 16:10~17:40**
- Room: 2F Udo
- Organizer: Prof. Hyungbo Shim (Seoul Nat'l Univ., Korea) & Prof. Soohye Han (POSTECH, Korea)
- This mini-symposium has been specially organized to share and exchange recent results between five Korean professors and the well-known scholar, Prof. Luca Zaccarian (LAAS-CNRS, France & Univ. of Trento, Italy), by the chair, Prof. Soohye Han (POSTECH, Korea) of Technical Committee of Control Theory, ICROS. All participants to ICCAS 2017 are strongly encouraged to attend this special symposium to discuss on the recent advances on nonlinear controls. Each talk is 30 minutes long, and six presentations are delivered by two consecutive sessions
- Program:
 - Session 1 [WB6] 13:10~14:40**
Chair: Prof. Hyungbo Shim (Seoul Nat'l Univ., Korea)
13:10~13:40 | "Practical Time-delay Control with Adaptive Gains" – Soohye Han (POSTECH, Korea)
13:40~14:10 | "Some Aspects of Nonlinear Control" – Dongeui Chang (KAIST, Korea)
14:10~14:40 | "Model Recovery Anti-windup with Applications" – Luca Zaccarian (LAAS-CNRS, France & Univ. of Trento, Italy)
 - Session 2 [WC6] 16:10~17:40**
Chair: Prof. Soohye Han (POSTECH, Korea)
16:10~16:40 | "Effect of Measurement Noise in Systems with Nonlinear Actuators" – Yongsoon Eun (DGIST, Korea)
16:40~17:10 | "Distributed Constrained Optimization over Networked Systems via a Singular Perturbation Method and Applications to Energy Distribution" – Hyo-Sung Ahn (GIST, Korea)

Control of Soft/Compliant Actuators

- Time: **[FB8] October 20(Fri) 13:10~14:40**
- Room: 8F Halla
- Organizer: Prof. Sehoon Oh (DGIST, Korea)
- Soft/compliant actuators, such as series elastic actuators and variable impedance actuators have attracted many researchers’ attention recently. In spite of their advantages in high performance force control, several issues are considered obstacles for them to be applied more widely. In this session, various approaches to tackle those issues are presented, particularly from the viewpoint of control algorithms. The following topics are included in this session.

- High Performance Force Control of Soft/Compliant Actuators
- High Precision Position Control of Soft/Compliant Actuators
- Modeling and Analysis of Soft/Compliant Actuator Behaviors
- Applications of Soft/Compliant Actuators
- States Observation of Soft/Compliant Actuators

- Program:

1. “The Role of Series Elastic Actuators in Human Assistive Robotics” – Kyoungchul Kong (Sogang Univ., Korea)
2. “A Cascaded Serial Elastic Rotational Actuator for Extended Linear Operation Range” – Hyuk Jin Lee, Hyungpil Moon, Hyouk Ryeol Choi, and Ja Choon Koo (Sungkyunkwan Univ., Korea)
3. “A Tendon-sheath Actuation with a Series-elastic Mechanism for a Tele-operation Control Interface” – Yeongtae Jung and Joonbum Bae (UNIST, Korea)
4. “Controller Tuning Strategy of Series Elastic Actuator for Reducing Impedance” – Wonje Choi and Jaeheung Park (Seoul Nat’l Univ., Korea)
5. “Comparison of Resonance Ratio Control and Inner Force Control for Position Control of Series Elastic Actuator” – SuHui Kwak and Sehoon Oh (DGIST, Korea)



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