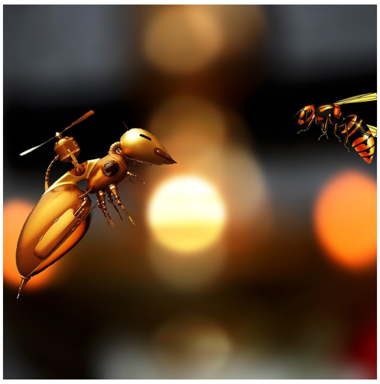
Keynote Forum
October 22, 2018

Robotics & Biomaterials 2018



International Conference on

Robotics and Automation
&
Biomaterials and Nanomaterials

October 22-23, 2018 | Frankfurt, Germany

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Roger Bostleman

NIST, USA

Measurement science and test methods towards robot standards

The National Institute of Standards and Technology (NIST) has been researching various aspects of manufacturing robotics, in some cases stemming from military projects from the 1980's and beyond. Developments in robot cranes, healthcare robotics, and most recently performance measurements of mobile robots, mobile manipulators, and exoskeletons have occurred and will be the focus on this presentation. Highlights will include: the RoboCrane which was transferred to industry for Chernobyl and Fukushima nuclear disaster cleanup and for depainting aircraft; the Home Lift, Position, and Rehabilitation (HLPR) Chair; and novel measurement developments of six degree-of-freedom optical tracking systems, AGV's/mobile robots, mobile manipulators, and exoskeletons. Safety and performance measurement developments have led to new standards published or in process, including a new focus area currently underway towards standards for exoskeletons. Safety and performance of these wearable systems is critical and preliminary results of the new NIST internal review board study on exoskeletons will also be discussed.

Speaker Biography

Roger Bostelman is an Engineering Project Manager in the Intelligent Systems Division at the National Institute of Standards and Technology. Over his 40 years at NIST, he has managed the Intelligent Control of Mobility Systems Program, and numerous NIST and other organization technology research and development projects. Roger has designed, built, and tested mechanical systems and their interface electronics on autonomous vehicles, robot cranes, and robot arms, including an automated HMMWV, HLPR (Home Lift, Position, and Rehabilitation) Chair, AGVs; Flying Carpet RoboCrane and several other RoboCranes. He is Chairman of the ASTM Committee F45 on autonomous industrial vehicle performance standards and two subcommittees, Chairs the ASTM F48.91 on exoskeleton terminology and serves on test method standards subcommittees, and serves as expert on the ANSI/ITSDF B56.5 sub-committee for AGV safety, RIA 15.08 mobile manipulators, and ISO TC 299 safety of personal care robots. He holds a B.S. degree in Electrical Engineering from the George Washington University, an M.S. degree in Technical Management from the University of Maryland University College, and a PhD in Computer Science from the University of Burgundy, France. He has over 100 publications in books, journals, and conference proceedings and he holds 7 patents.

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Xin Zhao

Nanoai University, China

Minimum damage-oriented robotic enucleation for oocytes and cloned piglet produced by robotic SCNT

Since the first sheep was produced by somatic cell nuclear transfer (SCNT), cloned animals have been produced in many mammalian species. Nuclear transfer is a complicated procedure. Usually, only around 1-3% of reconstructed embryos developed into live cloned animals. This low success rate is considered to be the major limitation of extensive application of the SCNT technique in pigs. Here we developed a robotic SCNT manipulation process, in which operation consistency was kept and force/pressure in the process was well controlled to reduce the damage in manipulation process and increased the success rate of cloning. Experiment results show that the proposed robotic SCNT system reduce the mechanical damage of the oocytes, and lead to high development rate. In our experiment, we achieved the blastocyst rate of 21%, which is a better result by comparison to the blastocyst rate of 10-14% in pig cloning. Furthermore, robotic SCNT has been applied to pig cloning. We did thousands of robotic SCNT operations and transferred 510 reconstructed embryos into 6 pigs and obtained 13 cloned pigs at last. Our results demonstrate that the robotic SCNT not only relieves the operator from tedious cell operations, but also reduces the damage of the oocytes in SCNT.

Speaker Biography

Xin Zhao received the B.S. degree from Nankai University, Tianjin, P.R.China, in 1991, the M.S. degree from Shenyang Institute of Automation, CAS, Shenyang, P.R.China, in 1994 and the Ph.D. degree from Nankai University, in 1997, all in control theory and control engineering. Prof. Zhao was the recipient of 1999 Excellent Professor Award, Nankai University, 2000 Inventory Prize, Tianjin Municipal Government, 2002 Excellent Professor Award of "College Key Teachers Fund", Ministry of Education. His team pioneered robotic animal cloning and successfully got 13 cloned piglets in 2017

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Dirk J Broer

Eindhoven University of Technology, The Netherlands

Liquid crystal soft robotic elements: Triggered 2d and 3d morphing

Since their development in the 80's of last century, reactive mesogens (RM's) form a versatile class of soft matter materials that have find their way to a wealth of applications. The frozen-in molecular order of the polymer networks that they form upon polymerization brought a new dimension into liquid crystal technologies. Initially developed for their use as low shrinkage, low thermal stress coatings, the RM's demonstrated their function especially in optical applications. The large, temperature-stable and adjustable birefringence was adopted by the display industry for many purposes, varying from viewing angle enhancement to optical-retarder based 3D imaging optics. Presently, advanced optical applications for augmented reality and astronomy lenses are drawing much attention as well their use for soft responsive elements by triggered 2D or 3D shape deformations. The use of RM's for soft robotics applications is presently studied by many academic and industrial institutes. Triggered by heat, light or humidity the polymers change shape, surface structure or porosity. At Eindhoven University, we developed self-sustaining oscillators, cilia based micro-transport devices and haptic surfaces. Films deform from a flat to a complex, but pre-designed, shape with prospects to light-triggered origami and self-folding plastic elements. A completely new development relates to coatings that switch their surfaces from flat to corrugated with a preset topography. Or, in a different design, from dry to wet by controlled secretion of liquid. Properties that enable controlling properties as friction, grip, lubrication, stick, soil rejection, particle manipulation, etc. The lecture will discuss our newest developments in responsive liquid crystal polymer materials, giving a preliminary view on the future of RM's with advanced applications in the fields of oscillatory films, smart coatings, soft robotics and haptics.

Speaker Biography

Dirk J Broer is materials scientist specialized in polymer structuring. He joined Philips (Eindhoven, Netherlands) in 1973 where he developed materials for data storage, telecommunication and display optics. From 2003 to 2010 he was senior research fellow and vice president at the Philips Research Laboratories. In 2010, he was appointed as fulltime professor in Eindhoven to chair the Department Functional Organic Materials with a research emphasis on clean technologies as energy harvesting, water treatment and healthcare. From 2015 he is staff member at the Institute for Complex Molecular Systems in Eindhoven and coordinates a program on responsive soft materials. He founded the Institute of Device Integrated Responsive Materials, a joint initiative of South China Normal University and Eindhoven University of Technology. Broer is member of the Royal Netherlands Academy of Arts and Sciences. In total, he has 275 publications in peer reviewed journals and more than 120 US patents.

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Baolin Huang

Guangzhou University, China

Biomimetic localization of bone morphogenetic protein-2 bioactivity by chondroitin sulfate

Localization of bone morphogenetic protein-2 (BMP-2) with continuous and effective osteogenic stimulation is still a great challenge in bone regeneration. In our study, BMP-2 was tethered upon chondroitin sulfate (CS)-functionalized calcium phosphate cement (CPC) scaffolds via specific noncovalent interactions (in a biomimetic form). The fabricated scaffolds not only controlled the release kinetics and presentation state of rhBMP-2, but also effectively increased the expressions of bone morphogenetic protein receptors (BMPRs) and enhanced the recognitions of remained BMP-2 to BMPRs. In vivo studies demonstrated that BMP-2-loaded CS-functionalized CPC exhibited sustained release of the protein and induced high quality ectopic bone formation. Thus, this work could provide new avenues in mimicking bone extracellular matrix microenvironment and localizing growth factor activity for enhanced bone regeneration.

Speaker Biography

Baolin Huang is a young principal investigator of School of Life Science, Guangzhou University, China. In June 2011, he graduated from Donghue University, China as a Bachelor of Engineering. In June 2017, he completed his PhD under the supervisor of Prof. Changsheng Liu from East China University of Science and Technology, China. During October 2014 to October 2015, he studied at Queensland University of Technology, Australia as a Joint-Training PhD student. Since July 2017, he is a lecturer of Guangzhou University, China. He published 8 papers in Q1 Journals (mostly Materials Science, Biomaterials). He is the members of Chinese Society for Biomaterials, Queensland Chinese Association of Scientists and Engineers, and Australian Nanotechnology Network.

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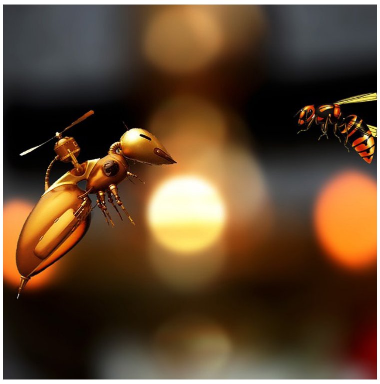


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Desineni Subbaram Naidu

University of Minnesota Duluth, USA

Fusion of hard and soft control strategies for a smart prosthetic/robotic hand

There are now over 20 million people in the world with missing limbs resulting from combat and non-combat operations and by 2050 there will be 50 million amputees all over the world. The availability of artificial limbs will help these people to lead a better normal life. The overall goal of the research on Prosthetic Hand Technology is to develop a smart prosthetic hand using intelligent strategies for electromyographic (EMG) signal extraction, analysis, identification, kinematic synthesis, and embedded hierarchical real-time systems and control by fusion of soft computing and hard computing techniques. The fusion of soft and hard control synergetic strategy alleviates the present problems associated with prosthetic devices. The presentation is based on Professor Naidu's recent (2016-August-12) TED Talk on 3-D Printed Prosthetic Hand for the World and his new research book published in October 2017 by the IEEE Press - Wiley (Series on Systems Science and Engineering) titled, "Fusion of Hard and Soft Control Strategies for a Robotic Hand".

Speaker Biography

Desineni Subbaram Naidu received MTech & PhD in Electrical Engineering, from Indian Institute of Technology Kharagpur (IITK), INDIA. He taught, visited and/or conducted research at IIT; National Research Council (NRC) Senior Research Associate at Guidance and Control Division at NASA Langley Research Center, Hampton, VA, USA (1985-90); Old Domain University, Norfolk, VA, USA (1987-90); as Professor, Associate Dean and Director, School of Engineering at Idaho State University and Measurement and Control Engineering Research Center, Pocatello, Idaho, USA (1990-2014). Since August 2014, he has been with University of Minnesota Duluth as Minnesota Power Jack Rowe Endowed Chair and Professor of Electrical Engineering. Professor received twice the Senior National Research Council (NRC) Associateship award from the US National Academy of Sciences (NAS), and is an elected (1995) (now Life) Fellow of the Institute of Electrical and Electronic Engineers (IEEE) and an elected (2003) Fellow of the World Innovation Foundation, UK. His teaching and research interests are Electrical Engineering; Control Systems; Optimal Control: Theory and Applications; Biomedical Sciences and Engineering (Prosthetics and Infectious Diseases); Large Scale Systems and Singular Perturbations and Time Scales (SPaTS): Control Theory and Applications; Guidance and Control of Aerospace Systems: Aeroassisted Orbital Transfer for Mars mission and Uninhabited Aerial Vehicles (UAVs); Advanced Control Strategies for Heating, Ventilation, & Air-Conditioning (HVAC); Modeling, Sensing and Control of Gas Metal Arc Welding (GMAW) and has over 200 journal and conference publications including 9 books.

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Jin-Woo Jung

Dongguk University, Republic of Korea

Nature inspired path planning for robotics

Path planning is one of the core research areas in robotics which deals with finding the optimal path for robots considering the required constraints. In this talk, we will revisit two primitive path planning methods, cell decomposition-based path planning and artificial potential field-based path planning. By using the inspiration from nature, new concepts using opposite angle and water-sink model are introduced for advanced path planning. These methods give us not only the efficiency but also the effectiveness in robot path planning problem.

Speaker Biography

Jin-Woo Jung received the B.S. and M.S. degrees in electrical engineering and Ph.D. degree in electrical engineering and computer science from Korea Advanced Institute of Science and Technology, Daejon, Korea, in 1997, 1999, and 2004, respectively. Since 2006, he has been with the Department of Computer Science and Engineering, Dongguk University, Seoul, Korea, where he is currently a Professor. During 2001–2002, he was a Visiting Researcher with the Department of Mechano-Informatics, University of Tokyo, Tokyo, Japan. During 2004–2006, he was a Researcher with the Human-friendly Welfare Robot System Research Center, Korea Advanced Institute of Science and Technology, Daejon, Korea. During 2014, he was a Visiting Scholar with the Department of Computer and Information Technology, Purdue University, West Lafayette, IN, USA. He has published more than 50 papers in reputed journals and has been serving as an editorial board member of several journals including Journal of Fuzzy Logic and Intelligent Systems.

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Parmeggiani C

University of Florence and LENS, Italy

Light-fueled microrobots: The winning combination of liquid crystalline elastomers and photolithography

The ability to control the shape of micrometric objects by means of light is an appealing opportunity to develop robotic devices on such length scale. In this field, we recently demonstrated how it is possible to fabricate Liquid Crystalline Elastomeric microstructures with nanometric resolution and to control their shape by light irradiation. LCEs, materials well known as artificial muscles, are able to perform different reversible deformations due to a liquid crystalline alignment variation in response to an external stimulus. Among the different synthetic strategies, photopolymerization of acrylate based mesogens enables to structure this material on the microscale by the use of Direct Laser Writing (DLW). This methodology has been applied to develop the first example of light driven microrobots: a two-step procedure allowed to fabricate a microwalker able to walk, crawl and jump under light irradiation or a microgripper able to catch a microparticle. This communication will show comprehensively our results, focusing on the design of liquid crystalline photoresists suitable for DLW and their patterning in the microscale, demonstrating how, starting from simple mesogenic monomers, it is possible to create polymeric microrobots with different abilities.

Acknowledgment: The research leading to these results has received funding from Laserlab-Europe EU-H2020 654148 and Ente Cassa di Risparmio di Firenze (2015/0781).

Speaker Biography

Parmeggiani C has completed her PhD in Chemical Science at the age of 29 years from University of Florence with Prof. A. Goti and she was recently awarded as researcher at the Chemistry Department of the University of Florence. Since 2010 she is associate at the European Laboratory for Non Linear- Spectroscopy and at the National Institute of Optics (CNR). In 2016 she was awarded with the "Organic Chemistry for environment, energy and nanosciences" prize from the Organic Chemistry Division of the SCI and she was a finalists of the European Young Chemist Award. She authored 37 papers, 1 book and 3 patents (h-index 16), on smart materials, stereoselective synthesis of iminosugars and new green oxidation methods that have been cited over 1150 times.

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Raziel Riemer

Ben Gurion University, Israel

Biomechanical energy harvesting as a base for exoskeleton: Theory, design and results

In this talk I will review the state of the art in exoskeletons technology. I will then focus on a biomechanical energy harvesters which are wearable robots designed to generate electrical energy from human locomotion (e.g. walking). Thus, providing an alternative to batteries as an electrical power source for portable electronics (e.g. GPS, laptops) or enable reduction of the dependence of exoskeleton in battery power. For an energy harvesting device to be useful, it is important that it can generate energy with minimal – or without any additional – effort of the user. Therefore, many of the current devices aim at replacing part of the muscles' work during the phases in human motion where the muscles act as brakes (i.e. negative work). This leads to regenerative breaking, which generates energy similar to a hybrid car. If performed correctly, this in theory could lead to generation of electrical energy while reducing the user's effort (i.e. metabolic power). In this talk I will explain the theory of an energy harvesting device, discuss the criteria for evaluation of the device, demonstrate the optimization base design approach, and present preliminary results of our device which indicate that it is possible to generate electrical energy while reducing the user's effort.

Speaker Biography

Raziel Riemer is an Associate professor at Dept. of industrial engineering and management at Ben-Gurion University of the Negev in Israel. He holds a B.Sc. degree in Mechanical Engineering and a M.Sc. in Industrial Engineering from the Ben-Gurion University of the Negev, and a PhD form Department of Mechanical and Industrial Engineering at the University of Illinois at Urbana-Champaign, USA. His research interests are in the areas of analysis, modeling, and simulation of human movement, as well as Robotics. He integrates knowledge from biomechanics and robotics. This research has implications, biomechanical energy harvesting, exoskeleton, ergonomics and physiotherapy. Before joining the academic world Raziel have worked in the industry both as a mechanical engineer and as industrial engineer for 6 year most of them at Intel.

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