自动化系

学术报告会

时间：2015年12月28日（周一）上午10:30

地点：电院楼群2-410会议室

Soft Smart Actuators: are they ready for soft robotics?

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Abstract:

Electroactive polymers, as soft smart materials, can be tailored as actuators or artificial muscles, which can be alternatives to some conventional actuation techniques. This is mainly due to their prominent features such as low electric power consumption (1V, 15-20 mA), lightweight, compliance, biocompatibility, being able to operate in air and liquid with a high speed (~ 400 Hz, depending on the size), insensitivity to magnetic fields and simplicity of fabrication. With this in mind, we have dedicated significant research work to understand and characterise the static and dynamics behaviours, and sensorless control of the actuators based on electroactive polymers typified by polypyrrole (PPy), and subsequently demonstrated various applications such as a swimming device, a mini crawling device inspired from cilia, a manipulation device, and a propulsion system based on the simple bending behaviour of these soft smart actuators. One challenging application would be in microrobotics, where the aim is to establish wireless and autonomous microrobots with a minimum foot-print. Another cutting-edge application is in soft robotics, where soft materials, especially electroactive materials, can be the key to realize soft robotics systems such as surgical devices, prosthetic devices including wearables and exoskeletons, co-robots, robot manipulators and mechanical positioners. In this talk, we are going to overview the soft actuators based on the electroactive polymers and their suitability to various cutting-edge applications. We will explain what soft robotics is and outline the significance of soft materials in establishing novel soft robotic systems. Short video-footages of the actuators operating in air will be shown to demonstrate their typical behaviour and suitability for real applications.

Biography:

Gursel Alici received the Ph.D. degree in robotics from the Department of Engineering Science, Oxford University, Oxford, U.K., in 1994. He is currently a Professor at the University of Wollongong, Wollongong, Australia, where he is the Head of the School of Mechanical, Materials and Mechatronic Engineering. His research interests are soft robotics, system dynamics and control, robotic drug delivery systems, novel actuation concepts for biomechatronic applications, robotic mechanisms and manipulation systems, soft and smart actuators and sensors, and medical robotics. He has published more than 280 refereed publications in his areas of research. Dr. Alici was a Technical Editor of the IEEE/ASME Transactions on Mechatronics during 2008–2012. He is a Technical Editor of the IEEE Access, the first IEEE open access journal with interdisciplinary scope. He was the General Chair of the 2013 IEEE/ASME International Conference on Advanced Intelligent Mechatronics held in Wollongong, Australia. He is the leader of Soft Robotics for Prosthetic Devices theme of the ARC Center of Excellence for Electromaterials Science. He received the Outstanding Contributions to Teaching and Learning Award in 2010 and the 2013 Vice-Chancellor's Interdisciplinary Research Excellence Award from the University of Wollongong.