Robots Everywhere: Air, Sea and In Close Proximity

Session co-chairs: Waleed Farahat, Rethink Robotics, and Dangxiao Wang, Beihang University

Science fiction aside, humans and robot systems have been largely separated from each other with minimal contact or interaction. Robots were simply too dangerous to physically coexist safely with humans. Furthermore, they were largely inaccessible to mere mortals: robots required specific and detailed instructions to execute tasks, lacked common sense, and necessitated careful structuring of their environments to be useful.

Recent advances have made robotic systems increasingly ubiquitous, operating in close proximity with humans in work environments, becoming common household items. In extreme cases robotic appendages are becoming an extension of the human with deeper levels of interaction. Speakers in this session will explore the engineering challenges, advances and new modalities for human-robot interaction, both physical and informational.

From the US side, Ross Knepper (Cornell University) will describe some of the enabling technologies that will allow us to rethink the way that factory automation functions including robots programming themselves taking loose guidance and social cues from humans. In doing so, Ross draws on insights from computer science, motion planning, sociology, psychology and linguistics for robots to interact through natural gesture. Tim Bretl's (University of Illinois at Urbana-Champaign) research takes human robot interaction to the extreme limits: designing prosthetic devices that augment and restore most basic functions such as locomotion, as well as designing non-invasive brain machine interfaces for command and control. Tim's approaches rely on control theory, robotics, and neurosciences

From the Chinese side, Chao Xu (Zhejian University) will talk about the working progress of the Shepherd Mission of the International Aerial Robotics Competition (IARC), including aggressive flight control, environment sensing from air, machine decision, integrated simulation environment, etc. He is leading the micro-aerial robotics team that won the First Prize of IARC in 2016. Based on the research topics mentioned above, some extensions and discussions will be made at the end concerning aerial craft design (such as aerial robot with parallel arm, tilt-rotors) and potential industrial applications. Junzhi Yu (Institute of Automation, CAS) will introduce the main motion characteristics of fish and summarize a general research technical route for bioinspired robotic fish. Then, on the basis of their recent research achievements in biomimetic robotic fish and robotic dolphins, he will elaborate on analysis and control for high-efficiency and high-maneuverability motions of robotic fish and robotic dolphins. Remarkably, dolphin flips and leaps, which were first implemented by physical robots, will also be introduced.