Ultra-Robotics: Challenges and Opportunities

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Abstract:
The past century has seen how robotics revolutionized the industries, creating great prosperities in the world by increasing efficiencies and productivities. However, at the beginning of the 21st century, globalization of the world economy and the rapid development of new technologies including information technology, nanotechnology, and biomedical technology have presented the robotics with new challenges and opportunities. Ultra-robotics is a new technology to enable the development of ultra-automation that can break the traditional dimensionality limitations of automation, thus bringing it to unprecedented ultra environments such as remote and nano environments. The development of information technology has created a new cyber infrastructure. Robots are the essential tools to interface cyber infrastructure with physical world, which is the key to the successful development and applications of cyber infrastructure. Furthermore, nanotechnology, which enables us to build devices and systems at enormously smaller scales than in the past are bringing fundamental changes to disciplines including engineering, chemistry, medicine, biology and physics. At present, one of the main challenges in nanotechnology is to develop efficient nano manufacturing methods which make devices and systems in nano scales. The research in the area of ultra-robotics is important in the development of nano manufacturing technology due to the fact that most physical magnitudes characterizing nano scale systems significantly differ from those existing in macro, meso, and micro systems. New challenges and difficulties in ultra-robotic technology arise from system modeling, analysis, and design to sensing, actuation, control and integration. Furthermore, ultra-robotics has great potential as a critical enabling technology in drug discovery for pharmaceutical industry. Over the past decade, the global pharmaceutical industry has been facing daunting challenges in scientific and technological innovations as a consequence of the increasing cost in the drug discovery process, the unmet medical needs and government regulations. It is evident that scientific innovations and development of new technologies to increase the efficiency and effectiveness of the drug discovery are essential to meet such challenges. In this talk the recent development in ultra-robotics will be presented with emphasis on applications in Internet based robotics, nano manufacturing and biomedicine. The theoretical foundations, implementation schemes and application examples will be discussed. The talk will conclude with discussions on challenges and opportunities in the field of ultra-robotics and ultra-automation.

About the Speaker:
Ning Xi received his D.Sc. degree in Systems Science and Mathematics from Washington University in St. Louis, Missouri, USA in December 1993. He is University Distinguished Professor, the John D. Ryder Professor of Electrical and Computer Engineering and Director of Robotics and Automation Laboratory at Michigan State University. Currently, he is on-leave from Michigan State University and serves as Chair Professor of Department of Mechanical and Biomedical Engineering and the Director of the Center for Robotics and Automation at the City University of Hong Kong. He served as the founding head of the Department of Mechanical and Biomedical Engineering at City University of Hong Kong (2011-2013). Dr. Xi received the Best Paper Award in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) in August, 1995, and the Best Paper Award in the 1998 Japan-USA Symposium on Flexible Automation. Dr. Xi was awarded the first Early Academic Career Award by the IEEE Robotics and Automation Society in May, 1999. He also received The Best Paper Award of IEEE Transactions on Automation Science and Engineering in 2007. Dr. Xi was awarded SPIE Nano Engineering Award in 2007. In addition, he is a recipient of US National Science Foundation CAREER Award. Dr. Xi is a fellow of IEEE. He also servedas the President of IEEE Nanotechnology Council (2010-2011), and a member of Administrative Committee of IEEE Robotics and Automation Society (2013-2015). He is the general chair of 2014 IEEE International Conference on Robotics and Automation. His research interests include robotics, manufacturing automation, micro/nano manufacturing, nano sensors and devices, and intelligent control and systems.

All are welcome!
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