

Ultra Automation: Challenges and Opportunities

by

Professor Ning Xi

Department of Electrical and Computer Engineering
Michigan State University
East Lansing, Michigan, USA

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ABSTRACT

Over the past century, automation technology has revolutionized the industries, creating great prosperities in the world by increasing the efficiency and productivities. However, at the beginning of the 21st century, globalization of the world economy and rapid developments of new technologies including information technology, nanotechnology, and biomedical technology have presented the automation with new challenges and opportunities. Ultra automation is a new technology to break the traditional dimensionality limitations of automation, thus bringing it to unprecedented ultra environments such as remote and nano environments. The challenges and opportunities arising from ultra automation will be discussed in this talk, focusing on ultra environments such as remote and nano environments. First, the development of information technology has added a new dimension to our life. Once the extent of financial possibilities was revealed, Internet-based applications/services expanded to cover every aspect of our lives. People can virtually trade, learn, play, control and do many other things over the Internet. This has enabled automation technology to overcome the distance barriers and reach an unprecedented environment. In this talk, the theoretical foundations as well as the implementation schemes to bring the automation over long distance will be discussed. The applications will include remote medical services and tele-manufacturing. The other dimension of the ultra automation is a nano environment. 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. Currently, one of the main challenges in nanotechnology is to develop efficient nano manufacturing methods which make the devices and systems in nano scales. The research in the area of automation 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 control and automation arise from system modeling, analysis, and design to sensing, actuation, and integration. In this talk the automation in nano environment will be presented with two examples, the first being in the development of the computer integrated nano assembly system. The second relates to the nano automation for bio-medical applications. The talk will conclude with discussions on challenges and opportunities in the field of ultra automation.

BIOGRAPHY

Ning Xi received his D.Sc. degree in Systems Science and Mathematics from Washington University in St. Louis, Missouri, USA in December 1993. Currently, he is the John D. Ryder Professor of Electrical and Computer Engineering and the Director of Robotics and Automation Laboratory at Michigan State University. Dr. Xi received the Best Paper Award in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) in August, 1995. He also received 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 also a recipient of US National Science Foundation CAREER Award. Dr. Xi is a fellow of IEEE. Currently he serves as the president of IEEE Nanotechnology Council. His research interests include robotics, manufacturing automation, micro/nano manufacturing, nano sensors and devices, and intelligent control and systems.

Enquiry: 2788 8420

All are welcome!