Nano/Tera Intelligent Systems

Abstract:

The guest lecture aims to introduce the development of intelligent mechatronic systems ranging from nano to macro scales. Specifically, two major research fields will be shared. They are: (a) the investigation of smart structures working with magnetorheological materials; and (b) dielectrophoretic manipulation of micron particles for biological and biomedical applications.

Magnetorheological (MR) materials, mainly consisting of MR fluids and MR elastomers, are smart materials that their mechanical and rheological properties can be controlled by an external magnetic field. Upon a magnetic is applied, the particle are magnetized to form into chain or column structures, which exhibit dramatic increase of damping or stiffness. Removal of the magnetic field, they immediately return to its free-status. This feature has enabled MR materials to find wide applications. The first part will include a number of research topics, including MR haptic devices; MR shear thickening fluids; sensing capabilities of MR elastomers; adaptive tuned MRE shock absorbers; self-powered MR dampers.

The second part will be will be focusing on the development of novel microfluidic devices for manipulation of micron particles using dielectrophoresis. The development of lab-on-a-chip (LOC) over the past decade, has attracted more and more interest, and aims to achieve the miniaturisation, integration, automation, and parallelisation of biological and chemical assays. Dielectrophoresis (DEP) is a phenomenon that occurs due to a translational force exerted on a dielectric particle in a non-uniform electric field. It has proven to be a versatile mechanism for manipulating various micro/nano scale bio-particles. In this part, the following research topics will be presented: (a) Development of simple and cost-effective micro-fabrication approaches; (b) development of novel DEP devices with 3D microelectrodes; and (c) development of insulator-based DEP microdevices. The application of microdevices for manipulation of biological particles will be demonstrated.

Additionally, this lecture will also introduce the University of Wollongong in terms of its history, education and research activities.

Short Biography- Weihua Li

Dr Weihua Li received his B. E. (1992) and M. E. (1995) degrees from University of Science and Technology of China, and Ph. D. (2001) degree from Nanyang Technological University Singapore. He was with the School of Mechanical and Aerospace Engineering of Nanyang Technological University as a research fellow from 2001 to 2003. He has been with the School of Mechanical, Materials and Mechatronic Engineering as a

Lecturer (2003-2005), Senior Lecturer (2006-2009), Associate Professor (2010 -2012) and Professor (2012-). He is the Director of the Engineering Manufacturing Research Strength and the Discipline Advisor for Mechatronic Engineering at the University of Wollongong.

Dr Li's research interests include smart materials and structures, microfluidics, dynamics and vibration control, and intelligent mechatronics. He has published more than 220 technical articles in refereed international journals and conferences. Dr Li is currently an Associate Editor of the journal of Smart Materials & Structures. He also sits on the Editorial Boards of other seven international journals. He has obtained a number of awards or prizes, including the prestigious JSPS Invitation Fellowship, and the Australian Endeavour Research Fellowship.