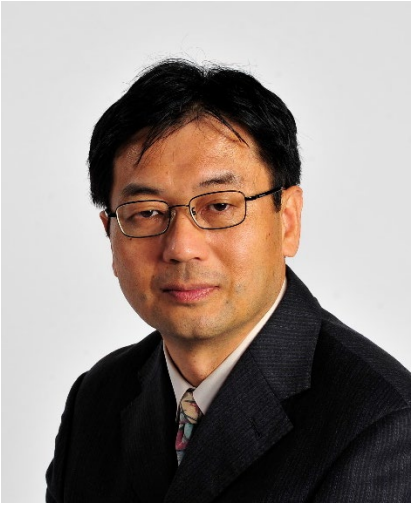

Keynote speaker:

Name:	**Qing Zhang**
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Title of the Presentation:

Electric Generators Based on Semiconductor Junctions

Short CV: Qing Zhang is a Professor at Centre of Micro-/Nano-electronics, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. His main research interests cover the electronic properties and applications of carbon based materials and other low dimensional electronic materials, energy storage devices and energy harvesting devices, etc.

Prof Qing Zhang and his team were one of the early groups who studied electron and heat transport in carbon nanotubes (CNTs). They found that heat transport in the CNTs is dominated by phonons, rather than electron transport. They have been studying the influences of metal/CNT contacts, adsorbed molecules and functional chemical agents on electron transport in CNTs since 1998 and have successfully demonstrated a variety of CNT electronic devices, including CNT logic gates, CNT OLED drivers, CNT flexible logic gates, CNT bio/chemical sensors, optical configurable CNT and ITO complementary logic gates, etc. They have made a significant contribution to enhance the stability of high specific capacity of carbon based anodes for Li-ion batteries. In 2014, they demonstrated high performance flexible Li-ion batteries with flexible coaxial Ni/PVDF nanofiber network and carbon fiber network. In 2017, Prof Zhang and his team successfully developed a unique electric generator with intermittently contacted p- and n-type doped semiconductor as the electrodes, in which both conduction and displacement current are generated. This is the first generator that possesses these characteristics.

Short abstract:

Electric generators convert mechanical power into electric power and they provide most of electric power for industry and our daily life nowadays. Since the first electrostatic generator was invented more than 370 years ago, many types of electric generators have been reported till now. Electromagnetic generators produce conduction current based on Faraday's law. In contrast, electrostatic generators and piezoelectric generators create displacement current under electrostatic induction and piezoelectric effect, respectively. In this talk, I shall outline the recent development in electric generators based semiconductor junctions. I shall concentrate on our recent work, i.e., p-n junction electric generators which could generate conduction current. These generators can be simply constructed using a pair of semiconducting or/and metallic electrodes which possess distinct chemical potentials. The generators can work in one of two working modes, i.e. the contact-separation mode and the sliding mode. In the contact-separation mode, electrons could diffuse from the high into the low chemical potential electrode once the two electrodes are brought in contact. A p-n junction, as well as a depletion region, is formed across the contacted surfaces. When the two electrodes are being separated, the space charges in the depletion region are then pumped to the external circuit and flow back to the high chemical potential electrode, converting the mechanical power to electrical power. With a small load resistance, conduction current and displacement current are clearly seen in the contact-separation cycles. By contrast, one electrode can be slid on the other electrode in the sliding mode. Electrons are generated through triboelectrification process at the contacted surfaces and they are then quickly swept out of the p-n junction by the built-in electric field, forming a conduction current across the contacted surfaces.