

**UNIVERSITY OF MACAU**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF ELECTRICAL AND COMPUTER**  
**ENGINEERING**

Ref: FST/SEM/00050/2013

**“Electrical Capacitance Tomography:  
From Principle to Applications”**

by

**Prof. Wuqiang YANG**

Professor

School of Electrical and Electronic Engineering

University of Manchester

**Date : 22/07/2013 (MONDAY)**

**Time : 16:00**

**Venue : J215**

## **Abstract**

Electrical capacitance tomography (ECT) is an imaging and measurement technique. It is based on measuring capacitance from a multi-electrode sensor and reconstructing cross-sectional images, representing the permittivity distribution of e.g. gas/oil/water flows in the oil industry and gas/solids distribution in fluidised beds in the pharmaceutical industry. The internal information obtained by ECT is valuable for understanding complicated phenomena, verifying CFD models, measurement and control of complicated processes. Compared with other tomography modalities, ECT is the most mature and offers advantages of no radiation, rapid response, non-intrusive and non-invasive, withstanding high temperature and high pressure and low-cost. Research into ECT involves sensor and electronic circuit design, data acquisition, computer interface, mathematics, finite element analysis, programming, and general knowledge in process engineering. Because of extremely small capacitance to be measured (down to 0.0001 pF) and the soft-field nature, ECT presents challenges both in engineering and mathematics. University of Manchester (formerly UMIST) pioneered the ECT research area. The latest ACECT system can generate on-line images at 300 frames per second with a signal-to-noise ratio of 73 dB. It has been used for many challenging industrial applications, such as gas/oil/water flows, wet gas separation, pneumatic conveyors, cyclone separators and fluidised beds. Recently, some medical application of ECT has been explored. It is foreseen that ECT will make impact on the gas and oil, pharmaceutical and power industries, and possibly healthcare. In this Lecture, the principle of ECT, capacitance measuring circuits, image reconstruction algorithms and some applications will be discussed, together with a demonstration of an ACECT system.

## **Biography**

Prof. Wuqiang Yang is a Fellow of the IET (formerly IEE), Fellow of the Institute of Measurement and Control (InstMC) and Fellow of the IEEE. He received BEng, MSc and PhD degrees from Tsinghua University. Since 1991, he has been with The University of Manchester (formerly UMIST) in the UK and now is a professor in the School of Electrical and Electronic Engineering. His main research interests include industrial tomography, especially ECT, image reconstruction algorithms, sensing and data acquisition systems, electronic circuit design, instrumentation and multiphase flow measurement. He has published over 300 papers, is a referee for over 40 journals (including 6 IEEE journals),

Associate Editor of IEEE Trans. Inst. Meas., editorial board member of 6 other journals (including Meas. Sci. and Technol.), guest editor of several journal special issues and visiting professor at 6 other universities. He received many awards, including the 1997 IEE/NPL Wheatstone Measurement Prize, the 1997 Honeywell Prize from the InstMC, the 2000 IEE Ayrton Premium, 2006 Global Research Award from the Royal Academy of Engineering, and 2009 IET Innovation Award Finalist. He is an Honorary Chairman of IEEE Int. Conference on Imaging Systems and Techniques (2009-2013). He is also the local chair of 2013 IEEE Int. Conference of Systems, Man and Cybernetics. His biography has been included in Who's Who in the World since 2002. He is currently an IEEE Distinguished Lecturer (2010-2016).

**ALL ARE WELCOME!**