

# WORKSHOP 6

## A half-day workshop in Advanced Power Electronics Technologies

Date : 19 February 2016 (Friday)  
Time : 9:30 a.m. – 1:00 p.m.  
Venue : Conference Hall 1-2, G/F, Core Building 1, Phase 1, Hong Kong Science Park, Shatin, Hong Kong

Topic : **The Role of Circuits and Systems Theory in Power Electronics: Methods, Applications and Case Studies**

Speaker : **Prof. Michael Tse**, Chair Professor of Electronic Engineering, PolyU EIE

### Abstract

Much of the power electronics discipline has been built upon the application of circuits and systems theory which spans across various aspects of fundamental circuit, control and system theory. However, in the process of developing solutions for new applications, the proper use of circuits and systems theory has not always been borne in mind, leading to unnecessary repetition and reinvention of concepts that would otherwise be reached directly if the approach taken had thoroughly considered the existing knowledge in circuits and systems. In this lecture, the role of circuits and systems will be revisited and examples will be shown to illustrate how proper application of existing circuits and systems theory would conveniently lead to important observations and conclusions that would save re-investigation or expedite understanding of the problems. Specific applications of current interest to be tentatively covered in this short tutorial include LED driving, power factor correction, parallel-connected converters, inductive power transfer, etc. In each application, the basic circuit theory relevant to analysis and design of the system in question will be expounded and its proper use will be shown to be crucial in gaining significant improvement in understanding the key properties and systematic generation of design solutions. It will be shown that even the basic principles of circuit duality and Kirchhoff's laws are not always appropriately exploited in power electronics, let alone proper application of these principles that would lead to systematic design approaches for LED driving and interconnection of power converters. Furthermore, use of power flow graphs and consideration of effect of parameter changes in conventional resonant circuits would be discussed, and their applications leading to systematic understanding of the design problems and classification of solution approaches for power factor correction circuits and inductive power transfer circuits will be illustrated.

### Biography

**Prof. Michael Tse** graduated from Melbourne University with BEng and PhD degrees. He is presently Chair Professor of Electronic Engineering at The Hong Kong Polytechnic University, and served as Head of his Department from 2005 to 2012 and on the University Council from 2013 to 2015. He has published 7 books and more than 300 journal papers in power electronics, nonlinear systems and communications. His research has been widely recognized internationally, having received a number of international research awards including IEEE Best Paper Awards, IEEE Distinguished Lecturer, and several other distinguished appointments by IEEE, universities and professional institutions. Granted 5 US patents and 1 Chinese patent, Prof. Tse has made his technologies in power conversion and LED lighting available for commercialization, which has also won him two Gold Medals in the International Invention Exhibitions in Geneva in 2009 and 2013. He is also Editor-in-Chief of two IEEE publications and Associate Editor for a number of IEEE and international journals. He is a member of the NSFC/RGC panel and serves on a few Hong Kong Government committees. He takes up a number of positions in professional committees, honorary and appointed, including IEEE Fellows Evaluation Committee, IEEE Long-Range Strategies Committee, IEEE Awards and Scholarships Committee, Board of Governors, etc. He is also appointed Honorary Professor of a number of universities in Australia and China. In 2009, he was appointed the prestigious Chang Jiang Scholar Chair Professor by Chinese Ministry of Education; in 2013 the Gledden Fellowship by UWA Australia and in 2015 Distinguished International Professorship by UWA Australia. Outside the engineering profession, Prof. Tse actively promotes culture and art, having served as Chairman of the university's Culture Promotion Committee since 2010 and as Director and Board Member of Hong Kong Sinfonietta. He is an IEEE Fellow and an IE Australia Fellow.