**Seminar on**

# On Characteristic Mode Tracking and Internal Resonance Removal

**by**

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**Date** : **18 August 2016 (Thursday)**
**Time** : **11:00 am – 12:00 noon**
**Venue** : **Room 15-202, 15/F, meeting room of State Key Laboratory of Millimeter Waves, 15/F, Academic 3, City University of Hong Kong**

**Abstract**

The Theory of Characteristic Modes (TCM) was formulated by Roger F. Harrington in 1971. TCM provides the inherent radiation and scattering properties of a structure, based only on the structure's geometrical and material properties. As such, it has been used for both analysis and design of a wide variety of antenna and scattering problems, including radar scattering, excitation of large structures with coupling elements and antenna shape synthesis. In recent years, the interest in TCM has grown rapidly, after it has been found to be particularly effective for solving challenging problems such as designing multi-antennas for compact MIMO terminals. However, to ensure the applicability of TCM to an even larger range of application contexts, several open issues need to be addressed.

In this seminar, two open issues in TCM research will be introduced and recent results will be presented. The first concerns the tracking of characteristic modes (CMs) over frequency, which is important for applications such as wideband antenna analysis and design. Although the CMs obtained from the generalized eigenvalue problem in TCM are orthogonal by definition, the orthogonality property among the modes do not hold across different frequencies. Moreover, some CMs can appear or disappear over frequency. Different mode tracking algorithms have been proposed, with varying degree of success in solving challenging cases.

Secondly, the computation of the CMs of dielectric and magnetic structures is still an interesting research topic. Although Harrington et al. proposed the use of volume- and surface-based formulations for this purpose already in the 1970's, the volume-based formulation is computationally complex, whereas the computationally efficient surface formulation results in internal (non-radiating) resonances in the CM solution. Several methods for eliminating the internal resonances will be presented, including a new approach based on physical bounds.

**Biography**

**Buon Kiong Lau** received the Ph.D. degree from Curtin University of Technology, Perth, Australia, in 2003, in electrical engineering. Since 2004, he has been with the Department of Electrical and Information Technology, Lund University, where he is now a Professor. His primary research interests are in various aspects of multiple antenna systems, particularly the interplay between antennas, propagation channels, and signal processing.

Between 2010 and 2016, Dr. Lau served as a Track Editor, Senior Associate Editor and Associate Editor for the IEEE Transactions on Antennas and Propagation (TAP). He was a Guest Editor of the 2012 IEEE TAP Special Issue on MIMO Technology and the Lead Guest Editor of the 2016 IEEE TAP Special Issue on Theory and Application of Characteristic Modes. He was the Lead Guest Editor of the 2013 Special Cluster on Terminal Antenna Systems for 4G and Beyond for the IEEE Antennas and Wireless Propagation Letters. From 2007 to 2010, he was a Co-Chair of Subworking Group 2.2 on "Compact Antenna Systems for Terminals" (CAST) within EU COST Action 2100. From 2011 to 2015, he was the Chair of Subworking Group 1.1 on "Antenna System Aspects" within COST IC1004. He is also a member of the Education Committee within the IEEE Antennas and Propagation Society (AP-S), where he served as the Coordinator for the IEEE AP-S Student Design Contest from 2013-2015. Dr. Lau received an award from the IEEE Transactions on Antennas and Propagation for exceptional performance as an Associate Editor during 2014-2015.

In 2014, Dr. Lau initiated and has since been leading an international Special Interest Group (SIG) on TCM (characteristicmodes.org), which aims to promote research activities and applications of TCM in solving different problems in electromagnetics. He has over 20 publications in the topic of TCM, including 2 patent applications and 7 IEEE journal papers.

***** ALL ARE WELCOME *****

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