

## Seminar on

### Microwave Imaging for Brain strokes

By

Prof Christian Pichot

Université Côte d'Azur, CNRS, LEAT, France

**Date** : 16 December 2016 (Friday)  
**Time** : 04:30 pm – 05:30 pm  
**Venue** : Room 15-202, meeting room of State Key Laboratory of Millimeter Waves,  
15/F, Lau Ming Wai Academic Building, City University of Hong Kong

#### Abstract

Stroke, or cerebrovascular accident (CVA), is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, and is a major cause of disability and death worldwide. About 85% of strokes are ischemic due to cerebral infarction, caused by an interruption of the blood supply to some part of the brain, 15% are hemorrhagic. Differentiating between these different types of strokes is an essential part of the initial workup of the patients because the subsequent management and treatment of each patient is vastly different. Rapid and accurate diagnosis is crucial. Neuroimaging has to play a vital role in the workup of acute stroke by providing information essential to accurately triage patients, and expedite clinical decision-making with regards to treatment. CT and MRI are actually the "gold" standards but they are bulky diagnostic instruments and cannot be used in continuous brain monitoring. A non-invasive and transportable/portable device would have clear clinical applications at the bedside in a Neurological Intensive Care Unit (NICU).

Microwave tomography is a novel, early development stage imaging modality with a large number of potential attractive medical applications. A difference between the dielectric properties (complex permittivity) of normal and diseased brain tissues is a great potential for this imaging modality. Detecting and identifying strokes is challenging as it corresponds to a small opposite variation of the permittivity values of brain tissues for the two types of strokes (ischemic or hemorrhagic).

This talk deals with microwave tomography for brain stroke imaging using state-of-the-art numerical modeling and massively parallel computing. Iterative microwave tomographic imaging requires the solution of an inverse problem based on a minimization algorithm (e.g. gradient based) with successive solutions of a direct problem such as the accurate modeling of a whole-microwave measurement system. Moreover, a sufficiently high number of unknowns is required to accurately represent the solution. As the system will be used for detecting the brain stroke (ischemic or hemorrhagic) as well as for monitoring during the treatment, running times for the reconstructions should be reasonable. The method used is based on high-order finite elements, parallel preconditioners from the Domain Decomposition method and Domain Specific Language with open source FreeFEM++ solver.

#### Biography

**Christian Pichot** is currently a Research Director at the French National Center for Scientific Research (CNRS), working at Electronics, Antennas & Telecommunications Laboratory (LEAT), joint Université Côte d'Azur and CNRS laboratory, 06900 Sophia Antipolis, France.

He received the Ph.D. and the Doctor of Science (D.Sc.) degrees from the University of Paris-Sud 11 in 1977 and 1982, respectively. In 1978, he joined the Systems and Signals Laboratory CNRS/Supélec, Gif-sur-Yvette, France, where he was Waves Division Leader from 1991 to 1992. In 1996, he joined Electronics, Antennas & Telecommunications Laboratory (LEAT), and was Director of the LEAT from 2000 to 2011. From 2008 to 2013, he was aco-director of CREMANT, a joint Antenna Research Center, supported by the University of Nice-Sophia Antipolis, CNRS and France Telecom Orange Labs.

In 2006 he has been co-organizing the 1st European Conference on Antennas and Propagation (EuCAP2006). He has been the organizer of the IEEE International Conference on Antenna Measurements and Applications (IEEE CAMA). He is an IEEE Fellow for "Contributions to Microwave Imaging and Antenna Designs".

His research activities are concerned with scattering and propagation of Electromagnetic Waves, radiation of antennas, inverse scattering (Microwave Imaging and Tomography, Antenna Synthesis, Complex Permittivity Reconstruction, Object Detection and Recognition) for applications in Radar, Civil engineering, non-destructive evaluation (NDE), non-destructive testing (NDT), geophysics, security and military applications, antennas, telecommunications, and medical domain.

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

#### Enquiries:

Professor Kwok Wa Leung, Department of Electronic Engineering  
Tel.: (852) 3442 9659 Fax: (852) 3442 0562 Email: [eeikleung@cityu.edu.hk](mailto:eeikleung@cityu.edu.hk)