

Seminar on

**Recent Medical Applications of Electromagnetic Wave Technologies**

by

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**Date : 08 February 2017 (Wednesday)**  
**Time : 11:00 am – 12:00 noon**  
**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**

Electromagnetic wave technologies have been used not only for telecommunications and broadcasting but also for medical and healthcare applications. Typical recent medical applications of electromagnetic wave technologies include:

- (1) Information / wireless power transmission:
  - Wearable or implantable vital data sensor
  - Wireless telemedicine / patient monitoring system in hospital
  - Advanced wireless capsule endoscopy
- (2) Diagnosis:
  - High intensity MRI (Magnetic Resonance Imaging)
  - Microwave CT (Computed Tomography) for cancer detection
  - Wireless sleep monitor / ECG (electrocardiogram) monitor
- (3) Treatment:
  - Thermal therapy (hyperthermia, ablation, etc)
  - Electric / magnetic brain or nerve stimulator
  - Surgical device (coagulation device, microwave knife, etc)

In this presentation, some recent medical applications of electromagnetic wave technologies are introduced. Firstly, a wearable dual-mode antenna for vital data monitoring systems is presented. A key technology for the system is body-centric wireless communications. Secondly, an X-band antenna for a microwave sleep monitor is demonstrated with human-body phantom experiments. A “dynamic” phantom played an important role for the study. Thirdly, a coaxial-slot antenna and an array applicator composed of several coaxial-slot antennas for minimally invasive microwave thermal therapy are overviewed. A few results of actual clinical trials by use of coaxial-slot antennas are demonstrated from a technical point of view. Finally, a few different types of surgical devices using high power microwave energy are introduced. Heating characteristics of such microwave surgical devices are evaluated by numerical calculation as well as experiments using phantoms, meat and animals. In addition, some future works are briefly discussed.

**Biography**

**Koichi Ito** received the B.S. and M.S. degrees from Chiba University, Japan, and the Ph.D degree from Tokyo Institute of Technology, Japan. He is currently a Professor Emeritus and Visiting Professor at the Center for Frontier Medical Engineering, Chiba University. From 2005 to 2009, he was Deputy Vice-President for Research, Chiba University. From 2009 to 2015, he served as Director of the Center for Frontier Medical Engineering, Chiba University.

His main research interests include small antennas for mobile communications, microwave antennas for medical applications such as cancer treatment, research on evaluation of the interaction between electromagnetic fields and the human body by use of phantoms, and antenna systems for body-centric wireless communications.

Professor Ito is a Life Fellow of the IEEE, a Fellow of the Institute of Electronics, Information and Communication Engineers, Japan (IEICE). He served as Chair of the Technical Committee on Human Phantoms for Electromagnetics, IEICE, from 1998 to 2006, Chair of the Technical Committee on Antennas and Propagation, IEICE, from 2009 to 2011, Chair of the IEEE AP-S Japan Chapter from 2001 to 2002, General Chair of the 2008 IEEE International Workshop on Antenna Technology (iWAT2008), an AdCom member for the IEEE AP-S from 2007 to 2009, an Associate Editor for the IEEE Transactions on Antennas and Propagation from 2004 to 2010, a Distinguished Lecturer for the IEEE AP-S from 2007 to 2011, General Chair of the 2012 International Symposium on Antennas and Propagation (ISAP2012), and a member of the Board of Directors, Bioelectromagnetics Society (BEMS), from 2010 to 2013. He currently serves as the IEEE AP-S Representative to Committee on Man and Radiation (COMAR) and a Councilor to the Asian Society of Hyperthermic Oncology (ASHO). He has been elected as a delegate to the European Association on Antennas and Propagation (EurAAP) since 2012 and Chair of Commission K, Japan National Committee of URSI (International Union of Radio Science) since 2015.

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