

**IEEE DISTINGUISHED LECTURER PROGRAM PRESENTS:**  
**OVERVIEW OF ELECTROMAGNETIC SCATTERING-BASED IMAGING TECHNIQUES**  
**by Jean-Charles Bolomey (University Paris-Sud XI, France)**

(sponsored by the IEEE Antennas and Propagation Society and the IEEE Hamilton Section)

**TIME: MARCH 29, THURSDAY, 3:30 PM to 5 PM**

**LOCATION:**

**McMaster University**

**1280 Main Street West**

**Information Technology Building – Annex, Room ITB/A113**

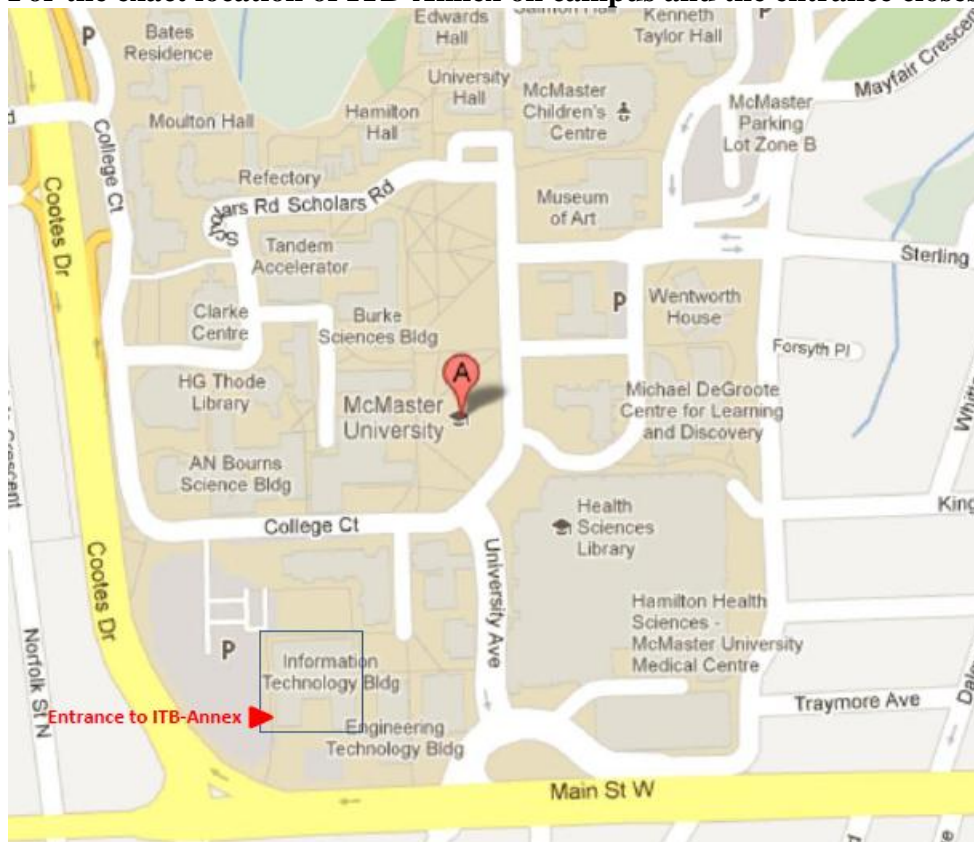
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For the lecture abstract and the biography of Prof. Bolomey, see next page.

## ABSTRACT

Making images consists in producing some footprints of a scene, allowing the human eye to view this scene. Intuitively, the footprint is supposed to show some kind of point-to-point correspondence between the scene and its image. Initially performed with natural light thanks to the human eye / brain combination, either alone or upgraded by means of optical instruments, the imaging procedures have been largely diversified during the last century. Such a diversification has been continuously stimulated by technological developments and led to consider new modalities to “see” objects escaping to human vision such as those buried in a medium opaque to the visible light. But penetrating opaque media usually requires operating at much larger than optical wavelengths, with the consequence that diffraction and scattering mechanisms, considered as second order perturbation in optical instruments, become first order effects decreasing image quality. For instance, the point-to-point correspondence between the observed object and its raw footprint is degraded or even may be apparently lost, requiring appropriate data processing. Many imaging systems dedicated to Industrial, Scientific, Security and Medical (IS2M) applications are based on electromagnetic waves, making them a convenient didactic support for a unified overview of scattering-based imaging techniques.

Starting from well-known imaging modalities, such as optical 3D holography and X-Ray tomography, the imaging problem is considered under the more general inverse scattering point of view. After reviewing major setup geometries and related reconstruction algorithms, some guidelines to design an imaging system and optimize its performance are given. The selection of the operating frequency band is more particularly addressed, due to its decisive impact on image quality and system complexity. The case of microwaves will be more particularly developed from various viewpoints, including holography, tomography and Near-Field microscopy. Several examples of imaging systems dedicated to IS2M applications are presented to illustrate the current potential and limitations of such generalized imaging techniques. In conclusion, their expected evolution for the future is discussed.

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## PROFESSIONAL BIOGRAPHY



**Prof. Jean-Charles Bolomey**  
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Jean-Charles Bolomey is currently an Emeritus Professor at Paris-Sud University. He graduated from the Ecole Supérieure d'Electricité (Supelec) in 1963, received his Ph.D. degree from Paris-Sud University in 1971, and became a Professor at this University in 1976. His research has been conducted in the Electromagnetic Research Department of the Laboratoire des Signaux et Systèmes, a joint unit of Supelec and the National Center for Scientific Research (CNRS).

Since 1981, his research contributions have been devoted to near-field techniques in a broad sense, including antenna measurement, EMC testing as well as Industrial-Scientific-Medical (ISM) applications. These contributions have largely concerned measurement techniques and have been deliberately oriented toward innovative technology transfer and valorization. Jean-Charles Bolomey has more particularly promoted the modulated probe array technology, demonstrating its unrivaled potential for rapid Near-Field scanning. He has co-authored with Professor F.Gardiol a reference book on principles and applications of the Modulated Scattering Technique (MST). He is holder of numerous patents covering various MST-based probe array arrangements for microwave sensing and imaging systems. In 1986, under the impulse of the National Agency for Valorization (ANVAR) and of the

CNRS, Professor Bolomey founded the Société d'Applications Technologiques de l'Imagerie Micro-Onde (SATIMO), which is now considered as a leading company in the field of antenna measurement. He has been also involved in industrial applications of microwave heating as a Chairman of the Microwave Group of Electricité de France (EDF) and was appointed as a consultant by the Délégation Générale de l'Armement (DGA) in the field of High Power Microwave (HPM) metrology. He has also actively contributed to several cooperative European Programs ranging from medical hyperthermia to industrial process tomography and has contributed to various prototype transfer and evaluation procedures in these areas. Recently, his research was related to RF dosimetry and rapid SAR measurements for wireless communication devices. Professor Bolomey his now continuing his research on load-modulated scattering antennas, and, more particularly, novel sensing applications of RFID technology. He is also contributing as a member of several

Jean-Charles Bolomey has received several awards, including the Blondel Medal of the Société des Electriciens et des Electroniciens (SEE) in 1976, the Général Ferrié Award of the French Academy of Sciences in 1984, and the Best Paper Award of the European Microwave Conference (EuMC) in 1983. In 1994, he has granted the Schlumberger Stitching Fund Award for his contribution to inverse scattering techniques in microwave imagery. In 2001, he has received the Distinguished Achievement Award of the Antenna Measurement Technique Association (AMTA) for his pioneering activity in the field of modulated probe arrays, and in 2007, elected as Edmond S. Gillespie Fellow for AMTA. He received the 2004 Medal of the French URSI Chapter. He has obtained the 2006 H.A. Wheeler Best Application Prize Paper Award of the IEEE AP-Society for his co-authored paper on "Spherical Near-Field Facility for Characterizing Random Emissions". Professor Bolomey is Fellow of the Institution of Electrical and Electronic Engineers (IEEE) and received the Grade Emeritus of SEE in 1995.