

# Technical Chapter IEEE IMS/CAS/COMMSOC (Florianópolis/South)

---

The Technical Chapter IEEE-IMS/CAS/COMMSOC (Florianópolis/South) invites you to the lecture **Unobtrusive Smart Sensing and Pervasive Computing for Healthcare** by Prof. Octavian Postolache, in the framework of the Distinguished Lecturer Program of the IEEE Instrumentation and Measurement Society.

- Date: 07th August, 2015
- Time: 10h00
- Local: Auditorium of the Electrical Engineering Department of Federal University of Santa Catarina, Florianópolis-SC.

**Abstract:** The world's population is ageing fast. According to the United Nations the median age for all world countries will rise from 28 now to 38 by 2050. Also, is estimated that by 2050, the population over 60 years will increase worldwide from 11% to 22%, a higher percentage (33%) of elderly population will be in developed countries. In this context, governments and private investors, in addition to work for increase efficiency and quality of healthcare, are searching for sustainable solutions to prevent increase expenditure on healthcare related with higher care demands of elderly people. As such, instrumented environments, pervasive computing and deployment of a seemingly invisible infrastructure of various wired and/or wireless communication networks, intelligent, real-time interactions between different players such as health professionals, informal caregiver and assessed people, are created and developed in various research institutions and healthcare system.

This presentation reviews the recent advances in the development of sensing solutions for vital signals and daily activity monitoring. Will be highlighted:

- Vital signals acquisition and processing by embedded devices in clothes and/or accessories (e.g. smart wrist worn) or in walking aids and transportation equipment such as walker or manual wheelchair. The strength and drawbacks regarding cardiac and respiratory assessment capabilities, the studies on cardiac sensing accuracy estimation and artefacts influence on cardiac function sensing through capacitive coupled electrocardiography, electromechanical film sensor and microwave Doppler radar ballistocardiography, reflective photoplethysmography will be discussed. Blood pressure, heart rate variability and autonomous nervous system activity estimation based on virtual sensors included in wearable or object embedded devices will also be presented.

- Daily activity signals acquisition and processing through microwave motion sensor, MEMS inertial measurement units, infrared multi-point and Laser motion sensors. Acquisition and conditioning of signals for motion assessment and theragames based on motion sensing and recognition will be presented. Using a set of metrics that are calculated using the information delivered by the unobtrusive sensors for motion capture, objective evaluation of rehabilitation session effectiveness can be performed. Several methods for diagnosis and therapy monitoring, as time frequency analysis, principal component analysis and pattern recognition of motion signals with application to gait rehabilitation evaluation will be described. The work under project Electronic Health Record for Physiotherapy promoted by Fundação para Ciência e Tecnologia, Portugal, for developing serious games for physiotherapy based on Kinect technology will be presented.

Concerning the embedded processing, communication and interoperability requirements for smart sensing devices a critical analysis of the existent solutions and a proposed innovatory

# Technical Chapter IEEE IMS/CAS/COMMSOC (Florianópolis/South)

solutions are discussed. Special attention is granted to wireless sensor network, M2M and IoT as so as to ubiquitous computing particularly smartphone apps applications for healthcare. A fast prototyping vital signs and motor activity monitor as so as the usage of IEEE1451.X smart sensor standards for biomedical applications are included in the presentation.

The creation of novel smart environments including remote vital signs and motor activity monitoring devices for health monitoring and physiotherapy interventions promote preventive, personalized and participative medicine, as in-home rehabilitation that can provide more comfort to the patients, better efficiency of treatments, and lower recovery periods and healthcare costs. The use of unobtrusive smart sensing and pervasive computing for health monitoring and physiotherapy interventions allow better assessment and communication between health professionals and clients, and increase likelihood of development and adoption of best practice based on adopting recognized research-based techniques and technologies, and sharing knowledge and expertise.



**Biography of the lecturer:** Prof. Dr. Octavian Adrian Postolache (M'99, SM'2006) graduated in Electrical Engineering at the Gh. Asachi Technical University of Iasi, Romania, in 1992 and he received the PhD degree in 1999 from the same university, he worked as assistant professor. In 2000 he became principal researcher of Instituto de Telecomunicações and Assistant Professor of EST/IPS Setubal in 2001. In 2012 he joined ISCTE-IUL Lisbon where he is currently assistant professor. His fields of interests are smart sensors for biomedical and environmental applications, pervasive sensing and computing, wireless sensor networks, signal processing with application

in biomedical and telecommunications, non-destructive testing and diagnosis based on smart eddy currents smart sensors, computational intelligence with application in automated measurement systems. He is currently leader of project regarding the implementation of Electronic Health Records for Physiotherapy (EHR-Physio). He is vice-director of Instituto de Telecomunicações/ISCTE-IUL delegation, and he was leader of several collaboration projects between the Instituto de Telecomunicações and the industry such as Home TeleCare project with Portuguese Telecommunication Agency for Innovation (PT Inovação), Integrated Spectrum Monitoring project with National Communication Agency (ANACOM). He is active member of national and international research teams involved in Portuguese and EU and International projects. Dr. Postolache is author and co-author of 9 patents, 7 books, 14 book chapters, 61 papers in international journals with peer review, more than 195 papers in proceedings of international conferences. He is IEEE Senior Member I&M Society, chair of IEEE I&MSTC-13 Wireless and Telecommunications in Measurements, member of IEEE I&MSTC-17, IEEE I&MSTC-18, IEEE I&MS TC-25, IEEE EMBS Portugal Chapter, He is active member of IEEE IMS TC-25 Subcommittee on Objective Blood Pressure Measurement Standard. He is Associate Editor of IEEE Sensors Journal, chair of IEEE MeMeA 2014 and received IEEE best reviewer and the best associate editor in 2011 and 2013. He was involved in the organization of different conferences thus he was member of IMEKO World Congress Organizing Committee, 2009. He served as co-chair of Sensornets 2012, Rome, Italy, Sensornets 2013 Barcelona, Spain, and Sensornets 2014, Lisboa, Portugal, and as chair of Pervasive HealthCare Workshop, 2012, San Diego, USA, general chair of IEEE MeMeA 2014, Lisbon, Portugal and as TPC co-chair of ICST 2014, Liverpool, UK. He is regular member of Technical Committee of IEEE IMTC, IEEE MeMeA, IEEE IDAACS and IEEE ICST.