IEEE Circuits and Systems Society Activity:

"Developing Inter-disciplinary Education in Circuits and Systems Community"

October 10th 2014, 10.00-12.00

Dipartimento di Elettronica, Informazione e Bioingegneria

Aula Beta, Edificio 24, Via Golgi 40, Milano

- **10.00-10.40: Marco Carminati,** Politecnico di Milano**:** ***"High-Resolution Impedance Sensing: Circuits and Applications"***
- **10.50-11.30: Lorenzo Codecasa,** Politecnico di Milano**:** ***"Novel Feedback Theory of Electric Circuits"***
- **11.30-12.00: Open Discussion**

High-Resolution Impedance Sensing: Circuits and Applications

Dr. Marco Carminati, Politecnico di Milano

e-mail: marco1.carminati@polimi.it

The cross-disciplinary miniaturization trend of sensors and devices demands for a concurrent integration and miniaturization of the detection electronics. Accurate transducer modeling and high-resolution readout become pivotal to leverage the sensing capabilities of microscale technology. Thus, low-noise analog circuits and systems for current and impedance detection are reviewed in this talk along with examples of novel applications of this instrumentation to environmental sensing (capacitive detection and analysis of single dust microparticles in air) and integrated photonics (noninvasive in-line optical power monitoring for closed-loop control of photonic circuits).

Marco Carminati (Milano, 1981) received B.Sc. and M.Sc. in Electronic Engineering, both *cum laude* from the Politecnico di Milano (Italy), in 2003 and 2005 respectively. IEEE member since 2007, in 2008 he was awarded a Rocca Fellowship and spent a semester at MIT (USA) working on BioMEMS and microfluidics. In 2009 he completed his Ph.D. in Electronics and Information Science at DEIB, Politecnico di Milano where he is currently a post-doctoral research fellow, designing and developing high-sensitivity microscale impedance sensors and low-noise instrumentation for nano-bio-science. He has authored 50 peer-reviewed international publications and holds one patent. He has been awarded two best paper awards in IEEE conferences and the outstanding referee mention from Rev. Sci. Instrum. Since 2014 he has been also teaching the “Biochip” graduate course.

Novel Feedback Theory of Electric Circuits

Prof. Lorenzo Codecasa, Politecnico di Milano

e-mail: lorenzo.codecasa@polimi.it

In this talk a novel cut-based decomposition for transfer functions of linear time-invariant circuits is introduced and an invariance property, with respect to the cut, is proven for the set of quantities introduced by this cut-based decomposition. These results are shown to naturally lead to a novel feedback theory of electric circuits which, unlike Bode's feedback theory, is based on the unambiguous decomposition of transfer functions. The novel feedback theory provides a natural extension to the elementary model of feedback amplifiers based on block diagrams, from system theory to circuit theory.

Lorenzo Codecasa (IEEE Member '06) received the Laurea degree (with highest honors) and the Ph.D. degree both in Electronic Engineering from the Politecnico di Milano, Milan, Italy, in 1997 and 2001. In 2002, he joined the Dipartimento di Elettronica e Informazione, Politecnico di Milano, as an Assistant Professor, where he has been an Associate Professor of Electrical Engineering since 2011. His research interests include electric circuit theory and simulation.