Report on IEEE CASS Outreach Activity 2017-476 "Emerging Topics in Circuits and Systems"

Tuesday, 19 December 2017

Politecnico di Milano, DEIB, Milan, Italy

This IEEE CASS Outreach Activity has consisted in a full-day meeting at Politecnico di Milano, between students, faculties and researchers, on topics that are relevant for the CASS community both in education and research. In the morning, a team of PhD students, researchers and faculty met to discuss about some emerging interdisciplinary topics in CAS community. Such topics include Modeling complex optical resonant nanostractures (interdisciplinary with Physics), Developing dynamical analysis and predictive tools in manufacturing industry (interdisciplinary with Economy).

Fig. 1. Prof. D'Amore acknowledges IEEE CASS support.

In the afternoon, Prof. Luca Daniel, Massachusetts Institute of Technology, held the educational seminar:"Simulation and Modeling of Complex Dynamical Systems". The event was attended by **more than 100 people**. The meeting was opened by Prof. Dario D'Amore, Politecnico di Milano, who introduced the speaker and acknowledged the support of the IEEE CASS. Details on how to join the CASS were provided to the attendees.

In his seminar, Prof. Daniel explained how many complex systems developed by engineers (e.g. magnetic resonance imaging scanners, nationwide electrical/gas/oil transportation network, finalcial or social networks) or found in nature (e.g. the human cardiovascular system, the brain neural network, biological systems, or the geophysical network of oil/water/gas reservoirs) can be viewed as large collections of interconnected dynamical system components.

The performance or characteristics of each individual component critically depend on what engineers or scientist refer to as second order effects, and can be captured only by resorting to accurate partial differential equation descriptions (e.g. Poisson, Maxwell, Navier-Stokes equations etc...).

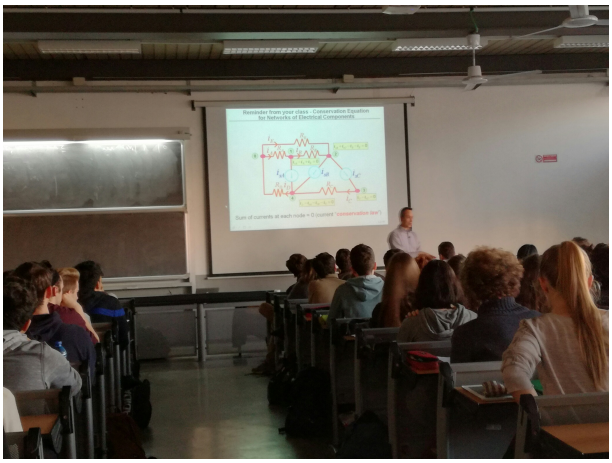

Fig. 2. Prof. Daniel explains conservation laws via equivalent circuits.

However, in many cases, such systems can be properly described by a set of conservation laws and constitutive equations that are analog to the basic laws governing electric circuits.

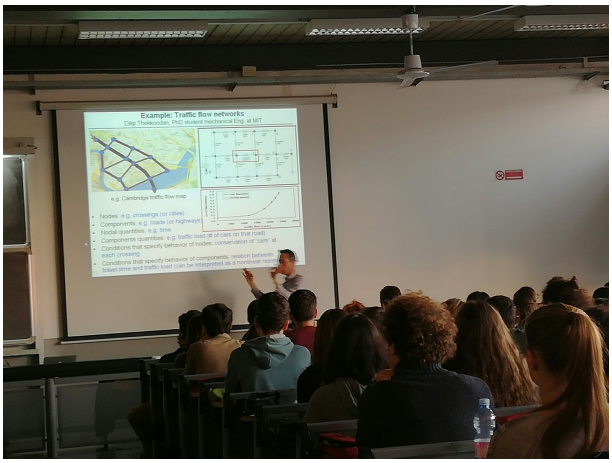

Fig. 3. Prof. Daniel shows the example of a transportation network.

Many of the theory/methodologies that are consolidated in the CAS community, e.g. circuits and systems modeling and simulation, nonlinear dynamics and system complexity, can be shared by other engineering communities in a cross-disciplinary way.