*Networked Control Systems Laboratory*
*Center of Excellence DEWS*
*Department of Electrical Engineering and Computer Science*

*European Embedded Control Institute*

# *EECI SEMINAR*


## Marco Di Renzo

French National Center for Scientific Research (CNRS) - http://www.cnrs.fr/
Laboratory of Signals and Systems (L2S) – UMR 8506 - http://www.lss.supelec.fr/
Ecole Supérieure d'Electricité (SUPELEC) - http://www.supelec.fr/
University of Paris-Sud XI (UPS) - http://www.u-psud.fr/
Paris, France


## Network-Coded Cooperative Wireless Networks: A Communication-Theoretic View


**Abstract:** Cooperative communications and Network Coding (NC) have recently emerged as strong candidate technologies for many future wireless applications, such as cellular networks, wireless sensor networks, fixed broadband wireless systems, vehicular and tactical networks. In particular, theory and experiments have shown that they can be extremely useful for wireless networks with disruptive channel and connectivity conditions. However, multi-hop/cooperative communications and NC are not without limitations: relay transmissions consume extra bandwidth resources, which implies that using cooperative diversity typically results in a loss of system throughput, while NC is very susceptible to transmission errors caused by noise, fading, or interference. In the light of their own complementary merits and limitations, it seems very natural to synergically exploit cooperation and NC to better take advantage and retain their key benefits while overcoming their limitations. For example, NC can be an effective enabler to recover the throughput loss experienced by multi-hop/cooperative communications, while the redundancy inherently provided by cooperation might significantly help to alleviate the error propagation problem that arises when mixing the packets. In this context, multi-source multi-relay networks, which exploit cooperation and NC for performance and throughout improvement, are receiving an always increasing interest for their inherent flexibility to achieving an excellent performance and diversity/multiplexing tradeoff. More specifically, considerable attention is currently devoted to understanding the achievable performance of such networks when both cooperation and NC are pushed down to the physical layer, and their joint design and optimization are closely tied to conventional physical layer functionalities, such as modulation, channel coding, and receiver design. However, no general framework for performance analysis and design of these systems exists in the literature, which is useful for generic network topologies, generic encoding vectors, and error-prone channels over all the wireless links. In this talk, we present our latest research advances on the characterization of the end-to-end performance of such networks with practical communication constraints. Closed-form expressions of diversity and coding gain for generic network topologies are presented, connections with classical coding theory are highlighted, and important considerations for network code design and performance optimization are given. The talk closes presenting research challenges and open research issues. ***This research is conducted under the auspices of the Marie Curie International Training Network (ITN), project grant "GREENET" – PITN-GA-2010-264759: http://www.fp7-greenet.eu/.***


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## AULA 2 REISS ROMOLI

**CONTACTS:** Prof. Fortunato Santucci (fortunato.santucci@univaq.it)