# Consiglio Nazionale delle Ricerche IEIIT
## Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni

# Brainstorming Session on Systems, Control and Networks

*The main objective of this session is to discuss current and emerging trends in systems biology, complex systems with uncertainty, and networks*

## Thursday, May 23, 2013

Conference Room, CNR-IEIIT
Politecnico di Torino
Corso Duca degli Abruzzi 24
10129 Torino

## Organizer and Chair: Roberto Tempo
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## Program

09:45-10:30: *Network system modelling challenges from mutation dynamics*
**Richard H. Middleton**, The University of Newcastle, Australia

10:30-11:15: *Convex relaxations of chance constrained algebraic problems*
**Constantino M. Lagoa**, Pennsylvania State University, USA

11:15-11:45: *Coffee & cookies*

11:45-12:30: *Topics in social networks: opinion dynamics and control*
**Paolo Frasca**, Politecnico di Torino, Italy and University of Twente, The Netherlands

12:30-13:00: *Discussion: at the crossroad of systems, control and networks*

# Abstracts

*Network system modelling challenges from mutation dynamics*

HIV is one of several examples of viruses with a high mutation rate. Attempts to model a full spectrum of classes of mutation, even with relatively simple ODE models for each mutant, can become prohibitively complex. I'll discuss some of the motivation for this problem, together with some of the biology of the virus, and some open problems in terms of modelling.


*Convex relaxations of chance constrained algebraic problems*

In this talk, we discuss some preliminary results on a general approach to chance constrained algebraic problems. In this type of problems, one aims at maximizing the probability of a set defined by polynomial inequalities. This class of problems is quite general and includes many problems in control systems where the system of interest is subject to stochastic disturbances and/or random uncertainty.

Maximizing probability of a semialgebraic set is, in general, non-convex and computationally complex. With the objective of developing systematic numerical procedures to solve such problems, a sequence of convex relaxations is provided, whose optimal value is shown to converge to solution of the original problem. In other words, we provide a sequence of convex (semidefinite) programs of increasing dimension and complexity which can arbitrarily approximate the solution of the probability maximization problem.


*Topics in social networks: opinion dynamics and control*

Control theorists have recently started to study social networks, and specially opinion dynamics. In this talk we present some recent outcomes of this interest, as well as some opportunities for research. First, we survey several models of the (uncontrolled) dynamics of opinions, discussing their advantages, shortcomings, and mathematical difficulties. Based on these models, we then consider how these dynamics can be controlled. As a bridge between dynamics and control, we touch upon the issue of defining the rank (or centrality) of a node.