



Politecnico
di Torino

PH.D. IN AEROSPACE ENGINEERING
COURSE III LEVEL

STRUCTURE AND DYNAMICS ON NETWORKS: CONSENSUS, SPREAD AND RESILIENCE



SPEAKER



Dr. Giuliano Punzo

University of Sheffield



University of
Sheffield

PROGRAM

CONTENT

The course focusses on the relation between network structure and the time evolution of typical dynamical processes on them. After having consolidated the nomenclature and fundamental mathematical concepts (mainly from linear algebra and non-linear systems stability), the course will highlight key differences between fully mixed systems and network systems when considering the same processes. Dynamical systems of interest are continuous time consensus and spreading mechanisms typical of virus spreading in epidemiology, but also used beyond that. The course focusses on analytical properties of network and touches upon numerical and experimental results available from the literature.

COURSE PLAN

LECTURE 1

MON 9 JUNE 2025 – FROM 2 PM TO 6 PM – 2ND FLOOR SALA FERRARI (DIMEAS)

- Networks and algebraic graph theory
- Elements of dynamical systems and stability

LECTURE 2

TUE 10 JUNE 2025 – FROM 2 PM TO 6 PM – 3RD FLOOR MEETING ROOM (DIMEAS)

- Linear consensus systems (with examples)
- Spread and recovery processes in network systems (biological inspired modelling of fault/disruption propagation in system)

LECTURE 3

WED 11 JUNE 2025 – FROM 2 PM TO 6 PM – 3RD FLOOR MEETING ROOM (DIMEAS)

- Controllability and Resilience
- Coding it (Including test)

BIO

Dr. Giuliano Punzo is a Lecturer in the School of Electrical and Electronic Engineering at The University of Sheffield, a position he has held since February 2019. In this role, he contributes to both research and teaching. His broader university responsibilities include serving as the Director and Transport Lead for the Urban Flow Observatory, the Head of Sustainability for the School of Electrical and Electronic Engineering, the University Transport Study Group correspondent for Sheffield, and the Chair of the University Transport Advisory Group. Beyond the university, DrPunzo is a STFC DAFNI Strategy board member and a Fellow of the Higher Education Academy. His research interests revolve around socio-technical systems, specifically focusing on sustainability and resilience, large infrastructure projects, fragile and conflict environments, dynamical system theory, control theory, complex systems dynamics, bio-inspired and multi-agent systems, infrastructure, transport, network science (including consensus and algebraic graph theory), and game theory, particularly dynamic and differential games on networks, oligopolies, and social dilemmas.



9 –11 June 2025



**DIMEAS
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