

PhD Course:

THE RESILIENCE ASSESSMENT OF COMPLEX SYSTEMS AS A MULTIDISCIPLINARY APPROACH FOR THE PREVENTION AND DISASTER MANAGEMENT

Telematic course via Teams platform

TEAMS CODE: 7siuxhd

AIMS AND CONTENTS :

The course aims to analyze the concept of resilience from several perspectives and research areas and applications within the PhD program in "Security, Risk and Vulnerability".

After a theoretical introduction to resilience formulations, definitions, indicators and dimensions, a series of seminars will follow to consider resilience from engineering, social, managerial, legal, risk and cyber-security perspectives. In the seminars, implications and prevention of, as well as actions in response to risks and crises will be examined.

The course is open to all PhD candidates of the University of Genoa interested to deepen the topic of resilience.

Attendance is strongly recommended to all PhD candidates from the Security, Risk and Vulnerability Program.

For information please email: serena.cattari@unige.it

PROGRAM (in brief):

INTRODUCTIVE THEORETICAL PART:

A reference framework for addressing disaster resilience studies

Friday, April 29 9:00-12:00

Serena Cattari, Associate Professor, DICCA – University of Genoa

THEMATIC SEMINARS:

9 Thematic seminars are planned on:

Tuesday, May 3 11:00 - 12:30 *from the cyber-security perspective*

Wednesday, May 4 11:00 - 13:00 *from the socio-political perspective*

Thursday, May 5 11:00 - 12:30 *from the cyber-security perspective*

Tuesday, May 10 16:00 - 18:00 *from the engineering perspective*

Thursday, May 12 11:00 - 13:00 *from the engineering perspective*

Wednesday, May 18 11:00 - 13:00 *from the engineering perspective*

Tuesday, May 24 16:00 - 18:00 *from the law perspective*

Wednesday, May 25 10:00 - 13:00 *from the managerial perspective*

Tuesday, May 31 11:00 - 13:00 *from the engineering perspective*



THEMATIC SEMINARS:

Resilience: a cyber-security perspective

Tuesday, May 3 11:00 - 12:30

Resilience of Cyber-Physical Systems

Armando Tacchella, Full Professor, DIBRIS - University of Genova

Thursday, May 5 11:00 - 12:30

Resilience in the Avionics and Aerospace Domains

Marco Bozzano (Fondazione Bruno Kessler, Trento, Italy)

Resilience: a socio – political perspective

Wednesday, May 4 11:00 - 13:00

Resilience and the EU Global Strategy

Fabrizio Coticchia, Associate Professor, DISPO- University of Genova

Resilience: an engineering perspective

Tuesday, May 10 16:00 - 18:00

Modelling and quantifying tomorrow's risks from natural hazards

Carmine Galasso, Full Professor of Catastrophe Risk Engineering, University College of London (UCL) and to IUSS (University School of Pavia)

Thursday, May 12 11:00 - 13:00

Natural slopes exposed to landslide risk: how to make them resilient?

Riccardo Berardi, Associate Professor and Rossella Bovolenta, Researcher, DICCA – University of Genova

Wednesday, May 18 11:00 - 13:00

Natural Hazards: a Never-ending Moving Target

Vitor Silva, Associate Professor, University of Porto (Portugal) and Risk Coordinator at GEM – Global Earthquake Model Foundation

Tuesday, May 31 11:00 - 13:00

Innovative solutions to support the urban flood resilience

Ilaria Gnecco, Associate Professor and Anna Palla, Researcher, DICCA – University of Genova

Resilience: a law perspective

Tuesday, May 24 16:00 - 18:00

Unforeseeable change of circumstances and the duty to contract renegotiation

Giorgio Afferni, Associate Professor, DIGI - University of Genova

Resilience: a managerial perspective

Wednesday, May 25 10:00 - 13:00

Effective Crisis Management: A Short Introduction to Best Practice

*Rob Britton, Adjunct Professor, Georgetown University and Imperial College Business School
Former Director, Marketing, American Airlines*



COURSE CONTENTS DETAILS

INTRODUCTIVE THEORETICAL PART:

A reference framework for addressing disaster resilience studies

Serena Cattari, Associate Professor, DICCA – University of Genova

Resilience is a broad and multidisciplinary subject and measuring it is one of the most challenging tasks due to the complexity involved in the process. In the seminar, the terminology, indicators, dimensions and metrics usually adopted in resilience studies are introduced to establish a unified framework, applicable to various research area, and introduce the concepts of "community resilience".

Various applications from available literature studies will be presented (including infrastructure networks, portfolio of buildings, strategic functions) that are the basis of life and economy of every community.

In the last part of seminar, the key points to improve the resilience of urban systems when subjected to high seismic hazard will be discussed in order to provide a first practical application of resilience studies. To this aim, tools to support the design of preparedness interventions before the seismic event, the emergency management and the recovery/reconstruction time will be illustrated. Emphasis will be given to the different urban functions for highlighting the strong multidisciplinary character of the topic. To this aim, the safety of the settlement life itself, the protection of the buildings and infrastructures that compose it and the preservation of the social identity of the urban system will be considered in a unified framework.

THEMATIC SEMINARS:

Resilience: a cyber-security perspective

Resilience of Cyber-Physical Systems

Armando Tacchella, Full Professor, DIBRIS - University of Genova

Cyber-Physical Systems (CPSs) interconnect the physical world with digital computers and networks in order to automate production and distribution processes.

Nowadays, most CPSs do not work in isolation, but their digital part is connected to the Internet in order to enable remote monitoring, control and configuration. Such a connection may offer entry-points enabling attackers to gain control silently and exploit access to the physical world at the right time to cause service disruption and possibly damage to the surrounding environment.

Prevention and monitoring measures can reduce the risk brought by cyber attacks, but the residual risk can still be unacceptably high in critical infrastructures or service and thus resilience is a key property for such systems. This seminar presents a research about a model-free, quantitative, and general-purpose evaluation methodology to extract resilience indexes from, e.g., system logs and process data. By using the model of a real wastewater treatment plant, and simulating attacks that tamper with a critical feedback control loop, we provide a comparison between four resilience indexes selected through a literature review involving over 40 papers. Our results show that the selected indexes differ in terms of behaviour and sensitivity with respect to specific attacks, but they can all summarise and extract meaningful information from bulky system logs.

Resilience in the Avionics and Aerospace Domains

Marco Bozzano (Fondazione Bruno Kessler, Trento, Italy)

This seminar is an introduction to the topic of resilience in the domains of avionics and aerospace.

We discuss the definition of resilience, and the topics of system design for resilience, fault management and fault tolerance. We then review existing safety standards, and we introduce classical techniques for safety assessment, such as hazard analysis, risk assessment and fault tree analysis. We conclude with an overview of the role of formal methods and tool support for safety assessment



Resilience: a socio – political perspective

Resilience and the EU Global Strategy

Fabrizio Coticchia, Associate Professor, DISPO- University of Genova

The seminar, which relies on the current scholarly debate in EU politics, Security Studies and International relations, focuses on the role played by the concept of resilience within the EU foreign and defense policy. Specifically, the seminar examines the EUGS - European Union Global Strategy where, moving away “from a narrative of democratisation at any cost”, the EU emphasized the need to adopt a “resilience-centred approach”. The EUGSS defined resilience as “the ability of states and societies to reform, thus withstanding and recovering from internal and external crises”.

Some authors have stressed the development of a “new EU common narrative on foreign and security policy”, positively highlighting the attention devoted towards local resources and practices, far from ready-made proposals. Others have viewed resilience as “the perfect middle ground between over-ambitious liberal peacebuilding and the under-ambitious aim of stability”. Finally, some scholars have critically conceived resilience as a vague concept that would have paved the way to de-politicization, underestimating inequality and the structural causes of the crisis.

The seminar will explore such debate, examining the relationship between resilience and other key-concepts of the recent EU foreign and defense policy (e.g., strategic autonomy, principled pragmatism), and highlighting the ways through which the approach has been conceived and implemented on the ground by the EU in order to address the governmental, economic, societal crises beyond borders.

Resilience: an engineering perspective

Modelling and quantifying tomorrow’s risks from natural hazards

Carmine Galasso, Full Professor of Catastrophe Risk Engineering, Univerisity College of London (UCL) and to IUSS (University School of Pavia)

Understanding and modelling future risks from natural hazards is becoming increasingly crucial as the climate changes, the human population grows, asset wealth accumulates, and societies become more urbanised and interconnected in many parts of the world. The 2015-2030 Sendai Framework for Disaster Risk Reduction recognises this need, emphasising the importance of preparing for the disasters that our world may face tomorrow through strategies to minimise uncontrolled development/densification in hazardous areas. While the vast majority of natural-hazard risk-assessment frameworks have so far focused on static impacts associated with current conditions and/or are influenced by historical context, some researchers have sought to provide decision-makers with risk-quantification approaches that can be used to cultivate a sustainable future. Modelling dynamic natural-hazard risk can support the development of meaningful decision support for urban development in the design of less-exposed and more-resilient cities and regions.

This talk will discuss these latter efforts, briefly examining work that is being carried out to model and quantify the individual components that comprise tomorrow’s risk, i.e., future natural hazards affected by climate change, future exposure (e.g., in terms of population and land use), and the evolving physical vulnerabilities of the world’s infrastructure. The talk will highlight challenges faced by modellers in determining the risks that tomorrow’s world may face from natural hazards and the constraints these place on the decision-making abilities of relevant stakeholders. Finally, the talk will introduce the risk-based, pro-poor urban design and planning framework (and its implementing Decision Support Environment, DSE) developed within the Tomorrow’s Cities project, the United Kingdom Research and Innovation (UKRI) Global Challenge Research Fund (GCRF) Urban Disaster Risk Hub. The Hub aims to support the delivery of the United Nations’ Sustainable Development Goals and priorities 1 to 3 of the Sendai Framework for Disaster Risk Reduction. In particular, the Tomorrow’s Cities DSE integrates physics-based natural hazard modelling, dynamic exposure and vulnerability (physical and social) modelling, consideration of multi-hazard scenarios, participatory approaches for identifying risk metrics tailored to the specific context and needs of the urban poor. The talk will discuss the ongoing implementation of the Tomorrow’s Cities DSE in Nairobi, Kenya, and Kathmandu, Nepal, where methodologies and guidelines for action-oriented, pro-poor, multi-hazard risk-based decision making are co-produced with local, national, and global stakeholders and research partners.



Resilience: an engineering perspective

Natural slopes exposed to landslide risk: how to make them resilient?

Riccardo Berardi, Associate Professor and Rossella Bovolenta, Researcher, DICCA – University of Genova

One of the most common strategies to mitigate landslide risk of a natural slope is to reduce its vulnerability by means of interventions. Therefore, the slope becomes less susceptible to the event (hazard) whose forecasting in time and space is very difficult on a probabilistic basis. The resilience of a slope exposed to landslides is the ability to recover from consequences of the hazard (landslide) in an effective manner. A slope can only be partially "self-resilient" (a slope reduction or the growth of new vegetation can be examples of self-resilience): anthropogenic interventions, if proper and well executed, combined with a better knowledge and awareness of the issues pertinent to landslide risk, can both increase post-event resilience and reduce pre-event vulnerability. Necessarily, in broad terms, the seminar deals with these topics.

Natural Hazards: a Never-ending Moving Target

Vitor Silva, Associate Professor, University of Porto (Portugal) and Risk Coordinator at GEM – Global Earthquake Model Foundation

Factors such as the increase in the global population, economic growth, climate change, and aging infrastructure are contributing to the increase in the impact caused by earthquakes. Despite the overwhelming evidence of the dynamic nature of earthquake risk, current disaster risk management is mostly informed by static risk information. Consequently, risk reduction strategies might rapidly become obsolete, insufficient and inadequate to properly address disaster risk. It is fundamental for risk modellers and decision makers to evaluate how the three main components (hazard, exposure and vulnerability) of earthquake risk are expected to evolve in the future, and how those changes will impact the trajectory of earthquake risk for the forthcoming decades. New technologies such as machine learning algorithms and remote-sensing datasets can be explored to perform these predictions, and create a new generation of risk metrics. Such analysis allows identifying the drivers of earthquake risk, and how risk reduction measures can be designed and implemented to achieve specific risk reduction targets.

Innovative solutions to support the urban flood resilience

Ilaria Gnecco, Associate Professor and Anna Palla, Researcher, DICCA – University of Genova

The seminar deals with the topics relating to the urban resilience to flooding and illustrates the main principles of the sustainable management of storm water in urban areas. In building the urban resilience to flooding, the design of sustainable urban drainage (SUD) systems involves an overall strategy finalized to mitigation of hydraulic risk, protection of ecosystems and improvement of liveability in urban areas.

In details, the seminar illustrates the design principles of the technical components of SUD systems as green roofs, permeable pavements, etc. and the description of innovative techniques as Decision Support System (DSS) to support the widespread implementation of these systems at the catchment scale.

Resilience: a law perspective

Unforeseeable change of circumstances and the duty to contract renegotiation

Giorgio Afferni, Associate Professor, DIGI - University of Genova

"Pacta sunt servanda" is one of the fundamental principles in contract law. As a general rule, parties are bound to the contract and may not terminate it or impose to the other party its renegotiation. However, under very special circumstances, some national laws request from the contract parties the renegotiation of contract in good faith in order to recover the original balance of rights and obligations, or facilitate such renegotiation. The goal of the seminar is to explore how the contract law doctrines of commercial impracticability and of unforeseeable change of circumstances may be used to allow the parties of a contract to deal efficiently with unforeseeable risks, avoiding the disruption costs caused by the manifestation of such risks.



ABSTRACT SEMINARS:

Resilience: a managerial perspective

Effective Crisis Management: A Short Introduction to Best Practice

*Rob Britton, Adjunct Professor, Georgetown University and Imperial College Business School
Former Director, Marketing, American Airlines*

All of us are emerging from what we hope is the gravest crisis of our lives, and this is a good time to think about how to manage crises effectively. In this lively talk, Rob distils a lifetime of leadership in the crisis-prone airline industry (he was part of the team that helped rebuild the American Airlines brand after the terrorist attacks of 11 September 2001) into a set of seven best practices to manage crises before, during, and after they happen: what to do before crisis strikes; how to keep control during the crisis; and actions to take after the crisis abates. There will be plenty of time for questions and discussion.

