

## HOW TO PARTICIPATE

In order to apply for this course please click the link below:

<https://www.polimi.it/index.php?id=5782&uid=4840&L=1>

and insert your application as requested.

The deadline for the application is **5/10/2021**

Minimum number of participants: 10

Maximum number of participants: 40

Once the minimum number is reached, you will receive a communication from the organization with all information about the payment of the registration fee.

## RESPONSIBLE ORGANIZATION

Department of Energy – Politecnico di Milano

## COURSE DIRECTORS

Prof. Francesco Di Maio – Department of Energy, Politecnico di Milano

Prof. Enrico Zio - Department of Energy, Politecnico di Milano

## DURATION AND MODE OF DEPLOYMENT

The course is held **ONLINE** from 12/10/2021 to 18/11/2021 - each Tuesday and Thursday from 14:00 to 18:00 (Rome time).

## REGISTRATION FEE:

€ 2800 (full registration fee)

€ 1300 (PhD students)

VAT is not applicable to the registration fees due to art. 10 DPR 633/26.10.72 and subsequent modifications.

PHD STUDENTS SHOULD ATTACH TO THE ONLINE REGISTRATION FORM THE OFFICIAL CERTIFICATE OF ENROLLMENT IN THE PHD PROGRAM OF THEIR UNIVERSITY, FOR THE CURRENT YEAR

## SCHOLARSHIP

The European Safety and Reliability Association (ESRA, [www.esrahomepage.eu](http://www.esrahomepage.eu)) supports the course with two scholarships to be awarded to PhD students. Scholarships will be assigned considering the affinity of the candidates' research to the topics of the course, the quality of the candidates' CV and the number and impact of publications in the field.

IF YOU ARE INTERESTED, PLEASE ATTACH YOUR CV TO THE ONLINE REGISTRATION FORM.

## COURSE PROGRAM CHAIR - TBC

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## COURSE SECRETARIAT

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DIPARTIMENTO DI ENERGIA

# ADVANCED QUANTITATIVE RISK AND RESILIENCE ASSESSMENT

**I Edition**

**12 October – 18 November 2021**

## Organizers:

Laboratory of Analysis of Signals and Analysis of Risk (LASAR)

([www.lasar.polimi.it](http://www.lasar.polimi.it))

Energy Data and Information Lab (EDILAB)

## Sponsorship:

ESRA (European Safety and Reliability Association)

## Support:

ARAMIS Srl, Milano, Italy

Cluster S2D2 (Cluster Security, Safety, Defense, Disaster Management and Recovery) of Politecnico di Milano

CRESCI (Center for Reliability and Safety of Critical Infrastructures), Beihang University, Beijing, China

IEEE – Reliability Society, Italian Chapter

Kyung Hee University, Department of Nuclear Engineering,

College of Engineering, Republic of Korea

MINES ParisTech, PSL Research University, CRC, Sophia

Antipolis, France

**COURSE PARTICIPANTS**

The course is mainly dedicated to risk analysts and engineers, resilience engineers, technical designers of industrial plants, safety and maintenance managers, asset managers, technicians and operators of surveillance, protection and control of the safety of a facility, researchers and PhD students in the area of Reliability Analysis and Risk Assessment.

**TRAINING FORMAT**

Lectures will be held in English. All participants will receive a complete set of the presentation slides with specific examples and case studies, selected reference lists and resources in electronic format. The first part of the course is devoted to the presentation of the classical Monte Carlo simulation methods for risk and resilience assessment and management, and advanced concepts on uncertainty (probabilistic, fuzzy, interval) and sensitivity analysis (variance- and distribution-based). In the second part of the course, advanced methods for risk and resilience assessment will be illustrated, including Bayesian Networks and Dynamic Bayesian Networks, Artificial intelligence and Evolutionary algorithms, complex systems and Human factors modelling. Hands-on sessions provide the participants with the opportunity of directly applying the methods to practical case studies (some of these will be held using MATLAB). Finally, in the last part of the course, participants will also be given the opportunity to discuss their experience and technical problems, related to methods and applications.

**CERTIFICATE OF ATTENDANCE**

At the end of the course, the participants will receive a certificate of attendance, provided that they have attended at least 80% of the course lectures.

**MISSION AND GOAL**

Systems are increasingly exposed to hazards of disruptive events, such as unexpected system failures, climate change and natural disasters, and malicious terrorism attacks.

In practice, risk assessment is applied to inform risk management on how to protect from the potential losses caused by the disruptive events. The focus is on the accident scenarios, their possible consequences and likelihoods, and the uncertainties therein. The post-accident recovery process is not considered. Yet, given that the sources of hazard leading to disruptive events are extremely uncertain and, thus, difficult to describe and model quantitatively, and that the systems are highly connected to each other so that the impact of the disruption extends beyond the boundary of the individual systems, an extension of the framework of assessment is necessary, calling for an integrated risk and resilience assessment framework that incorporates aspects beyond those of prevention, typical of risk assessment, in order to allow accounting for pre- and post-accident scenarios analysis.

In this sense, the course intends to present the methodologies that allow the integrated assessment of risk and resilience. In particular, the course intends to offer adequate technical-scientific knowledge on advanced risk and resilience assessment methods and provide the most recent methodological tools for their rigorous treatment.

**CONTENTS**

Monte Carlo simulation and Bayesian Networks (basic, multi-state and dynamic) for risk and resilience assessment and management; Uncertainty and sensitivity analysis, and Human factors in risk and resilience assessment and management; Resilience optimization; Artificial intelligence for risk and resilience assessment and management.

**Hands-on:**

Monte Carlo simulation, sensitivity analysis, Bayesian Networks.

**Round-table:**

Presentation and discussion of Case Studies, Researches, Experiences.

**LECTURERS (to be confirmed)**

**Piero Baraldi (PhD)**

Associate Professor  
Department of Energy, Politecnico di Milano

**Michele Compare (PhD)**

CEO  
ARAMIS Srl, Milano

**Francesco Di Maio (PhD)**

Associate Professor  
Department of Energy, Politecnico di Milano

**Giovanni Sansavini (PhD)**

Reliability and Risk Engineering Laboratory, Head  
Institute of Energy and Process Engineering, Department of  
Mechanical and Process Engineering, ETH Zurich

**Nicola Pedroni (PhD)**

Associate Professor  
Department of Energy, Politecnico di Torino

**Luca Podofillini (PhD)**

Senior scientist  
Laboratory for Energy Systems Analysis, Paul Scherrer Institute,  
Switzerland

**Enrico Zio (PhD)**

Full Professor  
Department of Energy, Politecnico di Milano  
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