6th PhD School on
Vulnerability, Risk and
Resilience of Complex
Systems and Critical
Infrastructures

T.I.M.E. Doctoral School

23-27 October 2017
CentraleSupélec, Université Paris-Saclay,
Paris, France

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and Reliability Association (ESRA).

Objectives

One of today’s major challenges is to integrate
the different disciplines involved in the design,
operation and maintenance of complex systems.
Examples are transportation systems (cars,
trains, airplanes...), energy production plants
(renewable energy, thermal and nuclear power...),
transportation and distribution networks
(energy transmission and distribution, water
distribution, gas transportation, road and
railway networks) etc. Company executives,
project managers, operation and design
engineers need to grasp the opportunities
coming from these complex, integrated systems
while avoiding risks, to the extent possible.
Decisions must be taken in uncertain
environments: then, uncertainty needs to be
handled, for effective and rational decision-
making.

The course aims at providing an advanced
training on concepts, methods and tools for
assessing and managing risks and opportunities
in complex systems. The course covers concepts
and methods for the evaluation, management and
control of technical risks, as well as the
uncertainties in the evaluations for confident
decision-support. The presented approaches are
notably based on Systems Analysis, Systems
Engineering, Applied Mathematics and Computer
Science,
The objective is to provide the adequate tools
for tackling the problem with scientific rigor.
The acquired concepts, methods and tools
constitute an essential part of the skills that
researchers, engineers and managers must have.

In the end, the course provides the knowledge
and competence need to architect and operate
complex systems, i.e. to make them efficient and
reliable in operation, and resilient to major
hazardous events.

One key objective of the course is to engage
multi-disciplinary and multi-cultural teams of
students in the definition, design and
development of a scientific research process in
the areas of interest for the disciplines of risk
assessment and uncertainty analysis. To this aim,
“mixed” teams of participants with different
backgrounds and Institutions of origin will beforme at the beginning of the course, and
charged with the definition and statement of a
research problem to be addressed. The
procedures and frames of work for the
development of original solutions to the
problems defined by the various teams will be
discussed in self-managed sessions at the end of
each day. At the end of the open seminar of the
last day of the course, the various teams will
have to present the definitions of the problems
and illustrate the research work that they
intend to carry out for their original solutions.
The teams will then have to continue the work
throughout the following semester, with the
objective of producing scientific papers
presenting the findings of the research. Once positively evaluated by the Professors of the School, these papers will be submitted to the appropriate international communities of peers for publication. Engagement by industrial partners in the monitoring of the projects will be sought. The benefits of the projects are expected to be an independent and direct exposure to: research problem definition and solution; multi-national, multi-cultural, multi-disciplinary, long-distance research work.

**Programme of teaching and key concepts**


**Project Work**

Multi-disciplinary and mixed teams (Politecnico di Milano, Leibniz Universität Hannover and CentraleSupélec) are going to be formed and given the task of defining, planning and conducting a research project on the topics of the Course, with the engagement of industrial partners. The project will be carried out over a period of six months. Eventually the original developments and results will be summarized in a scientific paper, which will be reviewed and, as done last year, possibly proposed for presentation to a Conference, if of adequate quality. This project is funded by the T.I.M.E. Association, an international network of 55 Higher Education Institutions. This T.I.M.E. project proposes to experiment innovative educational formats for fostering interaction between PhD candidates and industry. The main goals are in two directions: first, to give PhD candidates a concrete overview on research and innovation activities in industry and their own potential role in the future in such contexts; second, to put industry in contact with PhD candidates from different disciplines and in an international context. The PhD candidates will work in teams to identify possible solutions, guided by the industrial researchers and by tutors, and at the end will present and discuss their results. Lectures/seminars given by social scientists on the theme of interaction (both with external parties and within team members) will be also given during the course.

**Programme**

**Monday Morning (11:00 – 12.00):**

Registration

**LUNCH (12.00 – 13.00)**

Official opening of the PhD School

Definition of the project teams

Gwenaëlle Guillerme, Prof. Enrico Zio

**Monday Afternoon (14.30 – 19.00):**

Cultural and educational visit in Paris.

**Monday Welcome Dinner (19.00 – 21.00):**

To be announced

**Tuesday Morning (09.00 – 13.00):**

A modern vision of risk assessment (4h) Prof. Enrico Zio (CentraleSupélec/Politecnico di Milano)

**LUNCH (13.00 -14.00)**

**Tuesday Afternoon (14.00 – 18.00):**

14.00 -16.00: Tutorials + Project Work (2h) Francesco Di Maio (Politecnico di Milano)

16:30 – 18.00: Working Group Session with the presence of Industrial Partners

**Wednesday Morning (9.00 – 13.00):**

A modern vision of reliability engineering and prognostics and health management (4h) Prof. Piero Baraldi (Politecnico di Milano)

**LUNCH (13.00 -14.00)**

**Wednesday Afternoon (14.00 – 18.00):**

14.00 -16.00: Tutorials + Project Work (3h) Dr. Zhiguo Zeng (CentraleSupelec)

16:30 – 18.00: Working Group Session with the presence of Industrial Partners

**Thursday Morning (9.00-13:00):**
Advanced statistics (4h) Prof. Piercesare Secchi (Politecnico di Milano)

LUNCH (13.00 - 14.00)

Thursday Afternoon (14.00 – 18.00):
14.00 - 17.00 Tutorials + Project Work (3h) Prof. Simone Vantini (Politecnico di Milano)
17.00 - 18.00 Presentation preparation

Thursday Evening Dinner (18.00 – 21.00)
- Panel discussion (Round table with corporate partners) and Presentation and discussion of the team project proposals

Friday Morning (9.00 – 13.00):
Reliability and resilience of critical infrastructures by means of survival signature in uncertain environments (4h) Prof. Michael Beer and Matteo Broggi (Leibniz Universität Hannover)

LUNCH (13.00 - 14.00)

Friday Afternoon (14.00 – 17.00):
Critical infrastructure resilience modeling and optimization (4h) Dr. Yiping Fang (CentraleSupelec)

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