

# Dependability of Complex Systems Using Uncertainty Theories

**Duration:** 18 hours

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**Where:** DIBRIS - Via Dodecaneso, 35

## Abstract

This course introduces dependability methods using uncertainty theories (probability theory, possibility theory, belief functions theory, fuzzy sets theory), and shows techniques to improve and predict complex systems dependability. Concepts such as uncertainty classification in reliability data, elicitation of reliability experts' opinions, Levels 1 and 2 of probabilistic safety assessments (PSA), and Monte-Carlo Simulation techniques will be explained. Application of dependability methods for reliability and availability assessment of railway systems according to safety standards when dealing with imprecise failure data of components will be also explained.

## Program

- Introduction to the quantification of aleatory and epistemic uncertainties in dependability studies:
  - o Uncertainty classification in failure data.
  - o Elicitation of failure data from experts' opinions.
  - o Reliability method based on classical probabilistic approach : Level-1 probabilistic safety assessment (PSA)
  - o Reliability method based on Level-2 probabilistic safety assessment (PSA)
  
- Monte-Carlo Simulation techniques applied to reliability methods.
  - o Introduction to Statechart models.
  - o Random Number Generators.
  - o A simple Reliability problem based on MC simulation.
  - o MC simulation for reliability studies using MATLAB
  - o Application of Statechart models for dependability studies of railway systems.
  
- Uncertainty theories used in dependability methods.
  - o Introduction to fuzzy set theory
  - o Fuzzy Fault trees
  - o Fuzzy importance measures
  - o Introduction to belief functions theory
  - o Dependability methods using belief functions theory
  - o Modeling Failure dependencies between components
  - o Optimization methods for dependability studies of railway systems.

**References:** Material given by the trainer