Advanced Course in "Reliability and Risk Analysis"

4 -15 January 2016

IST, Universidade de Lisboa, Lisboa, Portugal

An advanced course on "Reliability and Risk Analysis" will be taught during 4-15 January 2016, at Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal, by experts in the field of risk analysis, covering topics such as reliability and design codes, hazard identification, system analysis and risk analysis. A set of practical examples will be given to students. The language of instruction and course materials is English.

This is a course that has been part of PhD programs at IST and while being now being adapted and included in the recently established PhD programme on "Analysis and Mitigation of Risks in Infrastructures" (<u>http://infrarisk.tecnico.ulisboa.pt</u>), organized by a Consortium of Portuguese Universities, the course is also open to the overall community.

This course will be an important opportunity for those developing work in the field of risk analysis or needing to apply reliability concepts. Details of the course syllabus can be found below.

Lecturers involved

Michael Faber: Professor at the Technical University of Denmark. His main research activities have been centred around structural reliability analysis, Bayesian decision analysis, reliability based structural design and assessment, probabilistic modelling of fatigue crack growth, probabilistic modelling of corrosion of concrete structures, risk based inspection and maintenance planning, modelling of preferences and consequences in decision making, generic approaches in risk assessment, large scale risk assessment and issues relating to sustainability.

Carlos Guedes Soares: Professor at IST, being the Head of CENTEC, the Centre for Marine Technology and Engineering. One of his main areas of research is uncertainty modelling and risk and reliability assessment, having been one of the Founding Members of the European Safety and Reliability Association (ESRA) and is Editor of the Reliability Engineering and System Safety Journal for more than 20 years.

Ângelo Palos Teixeira: Assistant Professor at Instituto Superior Técnico (IST), University of Lisbon, since 2004 and Principal Investigator of the research group on Safety and Logistics of Maritime Transportation of the Centre for Marine Technology and Ocean Engineering (CENTEC). His main scientific areas of research are related to risk assessment, maritime safety, structural reliability analysis of marine structures and systems reliability and maintenance.

António Araújo Correia: Research Fellow at the Earthquake Engineering and Structural Dynamics Division of the National Laboratory for Civil Engineering (LNEC), currently also serving as Technical Secretary at Sub-Commission 8 (Eurocode 8) of Technical Committee 250 (Structural Eurocodes) of the European Standardization Committee (CEN/TC250/SC8). His main expertise research and interests are in the fields of: seismic risk, structural vulnerability and code developments, as well as on the experimental assessment and numerical modelling of the seismic response of structures.

Romeu Vicente: Associate Professor at the Department of Civil Engineering at the University of Aveiro. His main research interests address fields such as seismic vulnerability assessment, seismic risk and loss assessment using GIS, strengthening and retrofitting of old building stock; has been involved in several research projects in the field of seismic vulnerability and risk assessment of masonry buildings and he is currently developing a manual on Good Practice in the Scope of Seismic Risk Management.

Teresa Viseu: Research Officer of the National Laboratory of Civil Engineering (LNEC) and the Head of Water Resources and Hydraulic Structures Division of the Water and Environmental Department; With a PhD on Civil Engineering her main expertise research and interests are in the fields of: hydraulic structures, fluvial hydraulics, hydrology and water resources; floods & dam risk management, dam-break flood assessment as well as emergency planning.









Detailed course syllabus

Reliability according to design codes, by António Correia (day 1 and day 2)

- Introduction to design codes
- Standardization of design principles
- Design criteria stated on a probabilistic basis
- Performance limit states
- The semi-probabilistic approach
- · Definition of characteristic value, design value and partial safety factor
- Calibration of safety factors using reliability analysis methods
- The full probabilistic approach
- · Simulation techniques and safety index

Hazard identification, by Ângelo P Teixeira (day 3)

- Introduction to Risk Analysis and Management
- Preliminary hazard analysis (PHA)
- · Hazard and operability analysis (HAZOP)
- Failure mode and effect analysis (FMEA)

System modelling and reliability, by Carlos Guedes Soares (day 4 and day 5)

- Fault tree analysis (FTA)
- Event tree analysis (ETA)
- · Reliability block diagrams
- System reliability

Risk analysis, by Michael Faber (day 6 and day 7)

- Consequences analysis: loss of life and quantification of economic losses
- Risk assessment and robustness
- Methods for the risk control. Cost-benefit analysis and cost-efficiency of control measures
- Tolerable and acceptable risk criteria. Risk perception, risk aversion and risk mitigation.

Examples of risk analysis applied to civil engineering, by Michael Faber (day 8)

Structural engineering

Examples of risk analysis applied to civil engineering, by Romeu Vicente (day 9)

- Earthquake engineering
 - Large scale vulnerability assessment methods and criteria
 - The use of GIS platform and programming for urban management
 - Physical damage and loss assessment scenarios case studies
 - Mechanical model methods and criteria case studies

Examples of risk analysis applied to civil engineering, by Teresa Viseu (day 10)

- Extreme climatic events
 - Understanding the risk management process for floods and droughts
 - Flood risk assessment methodologies and criteria
 - Vulnerability assessment of flood prone areas
 - Flood and drought risk mitigation and emergency preparedness planning