Vienna Doctoral Programme on Water Resource Systems

TU WIEN TECHNISCHE UNIVERSITÄT WIEN Vienna University of Technology | Bauhaus-Universität Weimar | RUHR UNIVERSITÄT BOCHUM RUB

Summer School on Risk

Sunday 29th July – Saturday 4th August, 2012

Vienna University of Technology, Austria

Lecturers and programme

Session 1: Opening
Prof. Dr. Christian Bucher
TU Vienna, Austria

Elements of probability theory and statistics

The lecture will first provide an overview of the fundamentals of probability theory such as conditional probabilities, types of distributions and models for random vectors.
A second part will focus on elementary statistics and deals with estimation of means and variances, the uncertainty of estimates and confidence intervals.

Session 2:
Prof. Dr.ir. A.C.W.M. Vrouwenvelder (Ton)
TNO-Delft, The Netherlands

Treatment of risk and reliability in Civil Engineering

Designing a structure comes essentially down to making decisions in the face of uncertainty. The aim of the decision-making process is to achieve a maximum profit (or minimum loss) considering all costs and profits during the expected life time of the structure, including the risk of malfunctioning or even collapse. In the most simple approach, risk is defined as the product of the failure probability and the corresponding consequences.

The existence of a failure probability is the result of the uncertainties in both loads on and strength of the structure. In order to calculate the failure probability one needs structural behaviour models, statistical data and calculation procedures. We will discuss the various methods to deal with these issues in civil engineering, both for structures (buildings, bridges) as for flood protection systems (dikes, dams, barriers).

The problems described above look like a pure mathematical problem in the first place, but there is also a large philosophical problem because of the uncertainties in the structural and

statistical models themselves. Apart from that there is also the problem of the imponderables in the optimization: how do we deal with the value of a human life or the loss of cultural and natural valuables. How do we deal with High Impact Low Probability events, and so on.

Ton Vrouwenvelder received his education at Delft University of Technology at the Department of Civil Engineering, where he is now a part time professor. He is an expert in reliability and risk analysis with applications to buildings, bridges, dikes and flood protection systems. He has contributed to the development of national and international design codes, is a member of many research committees and the former president of the Joint Committee on Structural Safety.

Session 3:
Dr. Silvio Tschudi
Allianz SE, Retrocession - Allianz Re, Munich, Germany

Quantify the unpredictable – cat risks in the insurance industry

Understanding natural perils, like earthquakes, windstorms or floods, is key for property insurers. However, experience is mostly low and adequate pricing for policies thus difficult. The course shall provide insights in insurance in general and give an overview on cat modelling in particular. This will include brief information on property insurance products (indemnity cover, parametric cover, portfolio protection) , portfolio management (scenario approach, event based approach), modelling techniques (from scenario over PML to fully fletched probabilistic models), uncertainty aspects (single risk vs. portfolio risk), data quality (descriptive attributes, geographical tools), and also touch on recent scientific development (seismic stress modelling, climate change) and how an insurance company can make use of it.

Session 4:
Dr. Jack F. Schijven
Expert Centre for Methodology and Information Services National Institute of Public Health and the Environment, The Netherlands

Part 1: QMRAspot - A computational tool for Quantitative Microbial Risk Assessment from surface water to potable water

QMRAspot is an interactive computational tool to conduct Quantitative Microbial Risk Assessment (QMRA) for drinking water produced from surface water. Raw microbial data are automatically read and analysed to demonstrate compliance with a health-based target for microbial safe drinking water of less than one infection per 10 000 persons per year for the index pathogens enterovirus, Campylobacter, Cryptosporidium and Giardia. QMRAspot provides guidance to the collection of the appropriate raw microbial data for QMRA and allows quick-and-clean risk assessment. QRMAspot and is freely available as Computable Document Files with the free CDF Player (Wolfram Inc).

Part 2: GWPcalc - A computational tool for calculating groundwater protection zones against virus contamination.
The groundwater protection calculator (GWPCalc) is a computational tool to calculate setback distances for the protection of groundwater against any virus or any other (bio)contaminant. It uses a removal rate coefficient, pumping rate, aquifer depth, pumping well screen depth, and aquifer anisotropy, accounting for dilution and for horizontal and vertical transport. GWPCalc is developed for sandy aquifers and includes a removal rate coefficient for passage through an unsaturated zone. Because contaminant source concentration is included, GWPCalc can be used for risk assessment. GWPCalc is freely available as Computable Document File with the free CDF Player (Wolfram Inc).

Session 5:
Prof. Dr. Michael Havbro Faber
DTU Civil Engineering, Lyngby, Denmark

Risk informed decision-making in engineering
The lectures will start out with a motivation for risk informed decision-making in engineering. The basic philosophy and framework for risk informed decision-making will be outlined in terms of the Bayesian decision analysis and it will be explained how uncertainties are to be represented and treated within this framework. Thereafter the methodology for systems risk modelling and assessment proposed by the Joint Committee on Structural Safety will be provided and it will be explained how this framework provides added value in decision-making for risk management in terms of indicators for the vulnerability and the robustness of systems as well as in decision-making in general. Finally the lectures will be rounded off by addressing sustainability and how this might be dealt with in engineering decision-making in a socio-economic context. This leads to the presentation of the Life Quality Index and some comments on the overall picture concerning societal risks at large scale.

Keywords: Decision Analysis, Risk, Probabilistic Modelling, Risk Assessment, Systems Modelling, Robustness, Sustainability, Life Safety and Global Catastrophic Risks.

Resources
Participants should bring their own laptop with them to Session 4.

Venue
Vienna University of Technology
Hörsaal 18, Second floor, Stiege 2,
Karlsplatz 13, Vienna

Registration
Advanced registration is essential as places are limited.
For further information and registration please contact:
Gemma Carr, Centre for Water Resource Systems, Vienna University of Technology
Phone: +43 1 58801 406655; Email: carr@waterresources.at

	Sun 29. July	Mon 30. July	Tue 31. July	Wed 1. Aug	Thur 2. Aug	Fri 3. Aug	Sat 4. Aug
9:00 – 10:30		**Session 1**: Opening Elements of probability theory and statistics (Prof. Bucher)	**Session 3**: Quantify the unpredictable – cat risks in the insurance industry (Dr. Tschudi)	**Session 5**: Risk informed decision-making in engineering (Prof. Faber)	PhD	**Excursion to Petzenkirchen Hydrological Open Air Laboratory (HOAL)**	Depart
11:00 – 12:30		**Session 2**: Treatment of risk and reliability in Civil Engineering (Prof. Vrouwenvelder)			Session organised by TU Vienna		
12:30 – 14:00		**Lunch**	**Lunch**	**Lunch**	**Lunch**	**Lunch**	
14:00 – 15:30		**Session 2** continued: Treatment of risk and reliability in Civil Engineering (Prof. Vrouwenvelder)	**Session 4, Part 1**: QMRAspot - A computational tool for Quantitative Microbial Risk Assessment from surface water to potable water (Dr. Schijven)	Session organised by Ruhr-University Bochum	**Excursion to Vienna Central Station**	Group work	
16:00 – 17:30		Session organised by Bauhaus-University Weimar	**Session 4, Part 2**: GWPcalc - A computational tool for calculating groundwater protection zones against virus contamination (Dr. Schijven)	PhD		Group work	
Evening	**Arrive**		**Vienna city tour**			**“Heuriger” evening**	