Spring Semester 2011 Lecture „Highly-integrated Systems“

Time / place lecture: Tuesday: 8 - 10 / CLA E4
Time / place tutorial: Monday: 10 - 11 / ML H34.3
Lecturer: W. Kröger

Goal: Developing a basic understanding of risk and vulnerability of complex systems including their interdependencies, taking energy systems and digital systems for industrial control as reference. Introduction to concepts of risk and vulnerability analysis as well as respective analytical instruments. Profound understanding of required traditional and advanced modelling techniques and software tools and their limitations. Applying methods to cases including risk analysis, assessment and management as well as systems' optimisation.

February

22 F I: Key terms, analytical goals and focal points, notion of system and complexity, set of failures, hazards and threats; management tasks

March

1 F II: Energy systems (generating plants, transmission grids, control systems) as complex infrastructure; methodological frameworks

8 RA I: Tabular methods of hazard/disturbance and effects analysis (FMEA, HAZOP), Master Logic Diagram, introduction into graph theory

15 RA II: Fault and event tree analysis, quantification (Boolean algebra, minimal cut sets), data needs and sources

22 RA III: Methodological uncertainties, Binary Decision Diagram

29 RA IV: Systematic failures (categorisation, modelling approaches), inclusion of common cause initiating events (earthquakes, etc.)

April

5 RA V: Human factors, human reliability analysis (THERP, SLIM, etc.)

12 AM II: Complexity and interdependencies, advanced modelling and simulation techniques(network theory)

19 AM II: Advanced techniques (object-oriented modelling, MC simulation, HLA)

May

3 RA VI: Scenario development, characterisation of accidental releases, atmospheric transport, models for impact analysis

RB I: Result representation (expected value, frequency-consequence-diagram, uncertainties), visualisation; integration

10 RB II: Principles and methods of risk evaluation (target lines, cost-benefit-analysis), criticality of infrastructures, decision making and tools

17 VA: Vulnerability and resilience (basic assumptions, models for quantitative analyses), engineering of robust systems

24 RM: Steps of risk management, emergency protection (concepts, legal requirements, analytical tools based on „real time“-information)

31 F: Comprehensive case study

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