

# 國立臺北大學自然資源與環境管理研究所

## 101 學年度第一學期 『環境災害與風險管理』

課程講義（十四）：風險分析與模擬工具軟體  
Software Packages for Risk (Hazard) Analysis and Simulation

<http://www.ntnu.no/ross/info/software.php>

Programs for RAMS (reliability, availability, maintainability, and safety) analysis

<http://www.palisade.com/>

Palisade Corporation: The DecisionTools Suite

<http://www.ihs.com/info/ehss/dyadem-stature-pha-pro.aspx>

EHS & Sustainability Software from HIS

- PURPOSES FOR UTILIZING SOFTWARE
  - Calculation, Computation, Analysis, Visualization, and Reporting (Presentation)
  - Program Coding, Spreadsheet, Hierarchical Viewing, and Visualization
  - Forms, Tables, and Figures => XML => Crystal Report
  - Reporting, Documentation, and Visualization => Soft Copies or Hard Copies?
- RISK ANALYSIS SOFTWARE
  - Statistics and Probability: Calculation, Fitting, and Visualization
  - Event Tree, Value Tree, Fault Tree, and Decision Tree => (PrecisionTree)
  - Reliability and Safety => Fault and Failure
    - ⇒ Fault Tree Analysis, FMEA, and FMECA
    - ⇒ Risk Priority Numbers (RPN) for Failures: Severity, Occurrence & Detectability
  - Process and Operation => Hazard and Operability
    - ⇒ Process Hazards Analysis: HazOp, Job Safety Analysis, etc.
    - ⇒ Brainstorming, Countermeasures, and Cost Assessment
- SOFTWARE PACKAGES FOR RISK (RELIABILITY) ANALYSIS
  - EHS & Sustainability Software from HIS (formerly Dyadem Software)
    - ⇒ FMEA-Pro Failure Modes and Effects Analysis
    - ⇒ PHA-Pro Process Hazards and Analysis: HazOp, What If, Checklist, FMEA & PrHA
    - ⇒ RiskSafe-Pro: improve the safety and ergonomics of your workplace procedures by conducting a Job Safety Analysis (JSA) or Job Hazard Analysis (JHA)
    - ⇒ SVA-Pro Security Vulnerability Analysis
  - Palisade Corporation: The DecisionTools Suite
    - ⇒ @RISK, PrecisionTree, TopRank, RISKOptimizer, (BestFit & RISKview)
    - ⇒ StatTools, NeuralTools & Evolver for prediction, data analysis and optimization.
    - ⇒ [Examples for Applying DecisionTools: Volcano Eruption](#) (Spreadsheet [1](#) & [2](#))
- QUANTITATIVE RISK ANALYSIS: SIMULATION AND OPTIMIZATION
  - Simulation vs. Optimization

- ⇒ System Simulation vs. Systems Analysis ⇒ System Dynamics
- ⇒ Wait-and-See? ⇒ Descriptive vs. Prescriptive Approach
- Representation of Uncertainty ⇒ Simulation
  - ⇒ Decision Making under Uncertainty (Risk)
  - ⇒ Simulation or Optimization? Simulation/Optimization (?)
- Monte Carlo Simulation
  - ⇒ Quantitative Risk Analysis
  - ⇒ Simulation and then Optimization
  - ⇒ Monte Carlo Simulation Steps
    - Step 1: Create a parametric model,  $y = f(x_1, x_2, \dots, x_q)$ .
    - Step 2: Generate a set of random inputs,  $x_1^i, x_2^i, \dots, x_q^i$ .
    - Step 3: Evaluate the model and store the results as  $y^i$ .
    - Step 4: Repeat steps 2 and 3 for  $i = 1 \dots n$ .
    - Step 5: Analyze the results using histograms, statistics, confidence intervals, etc.
- Stages involved in Producing a Monte Carlo Risk Analysis Model (Molak, 1997 Chp.I-4)
  - ⇒ Designing the structure of the risk analysis model
  - ⇒ Defining distributions that describe the uncertainty of the problem
  - ⇒ Modeling dependencies between model uncertainties
  - ⇒ Presenting and interpreting the risk analysis results
- Software Packages that can do Monte Carlo Risk Analysis
  - ⇒ Palisade @RISK; Oracle Crystal Ball

