Safety and Reliability of Engineering Structures

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP18/SRES	6 CP	180 h	3rd Sem.	Winter term	1 Semester
Courses			**Contact hours**	**Self-Study**	**Group Size:**
Safety and Reliability of Engineering Structures			4 SWS (60 h)	120 h	No Restrictions

Prerequisites

Basic knowledge in structural engineering

Learning goals / Competences

Basic knowledge of statistics and probability, a deeper understanding of the basic principles of reliability analysis in structural engineering, basic knowledge on how codes try to meet the reliability demands in regard to structural safety and serviceability, basic knowledge in simulation techniques. After successfully completing the module, the students

- know how to specify and efficiently solve the failure integral for structural engineering design purposes by numerical integration and/or simulation,
- understand the basic philosophy behind the structural design codes in regard to safety and serviceability.

Content

- Introduction: causes of failures and basic definitions safety, reliability, probability, risk
- Basic demands for the design and appropriate target reliability values: Structural safety, Serviceability, Durability, Robustness
- Formulation of the basic design problem: $R > E$
- Strategies for the solution of the failure integral
- Descriptive statistics: position (mean value, median value), dispersion (range, standard deviation, variation coefficient), shape: (skewness, kurtosis), unbiased and biased estimators for describing parameters based on confined ensembles
- Identification of outliers
- Strategies to meet confidence demands for estimated design values based on confined ensembles
- Theoretical distributions: Discrete distributions (Bernoulli and Poisson Distribution), Continuous distributions (Rectangular, Triangular, Beta, Normal, Log-Normal, Exponential, Generalized Extreme Value Distributions, Generalized Pareto Distribution)
- Failure probability and basic design concept
- Code concept - level 1 approach
- First Order Reliability Method (FORM) - level 2 approach
- Full reliability analysis - level 3 approach
- Probabilistic models for actions: dead load, imposed loads, snow and wind loads, combination of loads
- Probabilistic models for resistance: cross section – structure
- Further basic variables: geometry, model uncertainties
- Strategies for effective Monte-Carlo Simulations: Pseudo-random numbers, basic transformation methods, correlated variables
- Vulnerability
- Probability distribution of the failure probability
- Non-linear analysis

Teaching methods / Language Lecture (2h / week), Exercises (2h / week) / Homework (45h) / English
Mode of assessment Written examination (120 min, 100%) / Project work on simulation techniques
Requirement for the award of credit points Passed project work and passed final module examination
Module applicability MSc. Computational Engineering, MSc. Bauingenieurwesen
Weight of the mark for the final score 6 %
Module coordinator and lecturer(s) PD Dr.-Ing. M. Kasperski
Further information