

Structural Reliability of existing hydraulic structures in biaxial bending

Background

The average age of an existing hydraulic structure in the German inland navigation system is around 50 years. Therefore, the design standards and methods with which they were constructed have changed with time. The structural safety of these structures needs to be reassessed with new methods and failure mechanisms. Existing hydraulic structures differ from other structures in geometry, design loads and their combinations. The most prominent loads are water pressures producing uplift pressure in cracked and uncracked sections. The difference in water levels in/around the structure and various load combinations lead to several structural assessment scenarios. The project aims at the reliability assessment of a typical structural geometry and loading experiencing uni/bi-axial bending in presence of cracked sections and uplift pressures.

We expect that the student is familiar with structural analysis, reliability analysis (e.g. by completing the course *Structural reliability*). Good mathematical and programming skills will certainly prove helpful in this project.

Objectives

The learning outcomes of research would be

- Current methods for structural analysis of hydraulic structures.
- Implementation of structural reliability methods.
- Research on methods for crack development and propagation in mass concrete structures.
- How uplift and uni/bi-axial bending stress develop and affect the structural reliability.
- Sensitivity analysis of influencing parameters.

Methodology

The proposed course of action in the project is as follows:

- Familiarization with existing structural analysis methods for hydraulic structure.
- Crack development and propagation in concrete structures.
- Probabilistic modelling of materials, load parameters and limit states.
- Implement the learned methods for practical examples.
- Develop a small toolbox for reliability assessment.

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