Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratory of Hydraulics,
Hydrology and Glaciology

Master's Thesis
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CFD simulation of flow over lateral diversion structures

Lateral diversion structures in rivers, such as side weirs and overflow embankments, are common measures used to divert a part of the discharge into a lateral retention area or into a flood corridor during major flood events (Fig. 1). In this way, the inundation risk for downstream areas can be reduced. Numerical models commonly used in hydraulic engineering and for flood risk assessment can serve as tools for the design of lateral diversion structures.

Fig. 1: Lateral diversion of discharge into flood corridor during major flood event 2005 at Ennetbürgen-Buochs (NW). (Source: planat.ch)

Flow over lateral diversion structures was successfully simulated with 1D and 2D models. However, the amount of discharge in such simulations strongly depends on the side weir discharge coefficients and thus is subject to calibration. The goal of this project is to assess the local flow field at a lateral diversion structure and the impact of streamline curvature at the overflow section using a 3D numerical model. The results should be compared to the 1D and 2D simulation approaches, as these models are common in hydraulic and river engineering practice. This project is divided into three parts: (i) validation of the 3D model setup based on a frontal sharp-crested weir, (ii) create a 3D geometry of a lateral diversion structure with sharp-crested weir using a CAD software and run simulations, (iii) analyze different broad-crested weir shapes to estimate side weir discharge coefficients. This thesis may help practitioners to choose the suitable simulation approach and appropriate side weir discharge coefficient.

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Remarks: Research-oriented thesis; Communication and report in English or German; Basic numerical modelling skills are required.