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Modelling of attraction flow for upstream fish passage

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To restore river connectivity, functional fishways at hydropower dams are indispensable. Functionality strongly depends on the ability of migrating fish to find the entrance of the fishway without major delays. In order to increase attraction efficiency in competition to the bulk discharge from the draft tubes, auxiliary water is supplied into the entrance pool and thus an attraction flow perceptible to the fish is generated. Its propagation in the tailrace is influenced by the mostly heterogeneous and strongly secondary flow dominated velocity field coming from the draft tubes. The challenge is to determine the minimum required flow rate to reach a certain distance with the attraction flow.

To answer this question we use numerical models created with the interFoam solver from the OpenFOAM library. To achieve a high prognostic ability, the models must be calibrated for the relevant discharge conditions using suitable velocity measurements. Calibration is carried out by varying the velocity field at the inlet boundary of the draft tube. In addition to the swirl boundary condition used in Gisen (2017) (Fig. 1; 5c), simplified (Fig. 1; 5a and 5b) and more complex approaches (Fig. 1; 5d) for the velocity field at the boundary are tested. In conclusion the suitability of a boundary type depends on the flow conditions at site, the available data and the desired accuracy.

Literature