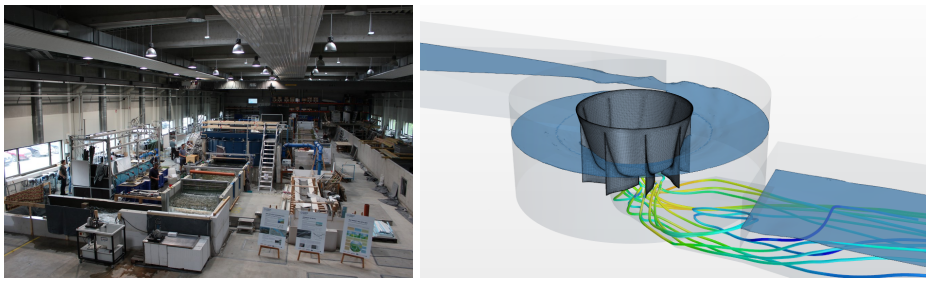
OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG
FAKULTÄT FÜR VERFAHRENS- UND SYSTEMTECHNIK

CFD improvement of a vortex power plant with focus on fish passage quality

Master's Thesis at the *Lehrstuhl für Strömungsmechanik und Strömungstechnik*

As part of the *Fluss-Strom* project [1], the laboratory is investigating the hydraulic performance of the "Fish-friendly Weir", a free-surface vortex power plant intended to operate as a safe fish passage for use along dams. Particular attention is given to the compromise between fish-friendliness and power production, which is investigated using numerical simulations [3]. These computational fluid dynamics (CFD) simulations already include a basic model for the prediction of impact between fish and turbine blades.



Experimental installation in the TU Dresden and simulation of the flow through the installation carried out at the laboratory

Now, a second prototype of the device is being installed in the Technische Universität Dresden[2], in which experiments involving live fish are carried out. This brings the opportunity for further development of CFD tools for assessing fish-friendliness. The Master's Thesis should thus include the following steps:

- In a family of fluid flow simulations reproducing the prototype installation, observation of monitors for fish-friendliness developed in previous work, when relevant parameters (e.g. turbine velocity, volume flow, outlet height) are varied;
- Continuous improvement of the weir through systematic variation of geometrical and operational parameters in CFD simulations.

The Thesis should thus result in the publication of specific recommendations and general design guidelines for improving the performance of a turbomachine with special focus on the quality of fish passage. We are looking for a bright person with great command of fluid dynamics, significant experience with CFD, and scientific writing skills to work with us on this exciting project.

[1] Wachstumskern Fluss-Strom Plus. *Grundlastfähige Energiegewinnung durch ökologisch verträgliche Flusswasserkraftanlagen.* German. Oct. 2015. URL: http://flussstrom.eu/.

[2] N. Müller and J. Stamm. "Errichtung eines 1:1 Labormodells für ethohydraulische Untersuchungen an einem Wasserwirbelkraftwerk". German. In: *Dresdner Wasserbauliche Mitteilungen (Heft 60).* Germany, Dresden, 2018.

[3] S. Müller, O. Cleynen, S. Hoerner, N. Lichtenberg, and D. Thévenin. "Numerical analysis of the compromise between power output and fish-friendliness in a vortex power plant". In: *Journal of Ecohydraulics* (2018, submitted).

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