

Universität Stuttgart

Institut für Strömungsmechanik und Hydraulische Strömungsmaschinen

Prof. Dr.-Ing. Stefan Riedelbauch

Pfaffenwaldring 10 D-70550 Stuttgart Telefon (0711) 685-63264 Telefax (0711) 685-63255

Master Thesis / Research Thesis Fluid Mechanics and Hydraulic Machinery

Supervisor:	M.Sc. Rohit Raj, DrIng. Alexander Tismer
<u>Begin:</u>	from May 2024
<u>Topic:</u>	REINFORCEMENT LEARNING ASSISTED SHAPE OPTIMIZATION OF AIRFOIL
	WITH APPLICATION TO HYDRAULIC MACHINERY

Cavitation is a huge challenge in the design process of Hydraulic machinery. Hence, design optimization is performed iteratively coupled with CFD simulations to refine blade parameterizations to reduce the cavitation volume. However, these methods often encounter limitations in exploring the vast design space efficiently and effectively due to high computational time and costs.

Supervised learning approaches have addressed these challenges, but are constrained by userprovided data. The utilization of **Reinforcement Learning (RL)** techniques introduces a paradigm shift in optimization process due to its generative capabilities.

The goal of this thesis is to implement a RL framework for the shape optimization of a 2D airfoil, with the ultimate goal of decreasing the cavitation volume.



Goals:

- Literature reviews about single-objective, multi-parameters shape optimization and hydraulic machinery
- Implementation of reinforcement learning strategies for shape optimization
- Validation of the new model

Prerequisites:

- Basic knowledge of CFD and Machine Learning (ML)
- Basic knowledge of programming in Python is advantageous.
- Basic knowledge about Fluid mechanics is necessary.

Contact

M.Sc. Rohit Raj rohit.raj@ihs.uni-stuttgart.de Dr.-Ing. Alexander Tismer alexander.tismer@ihs.uni-stuttgart.de