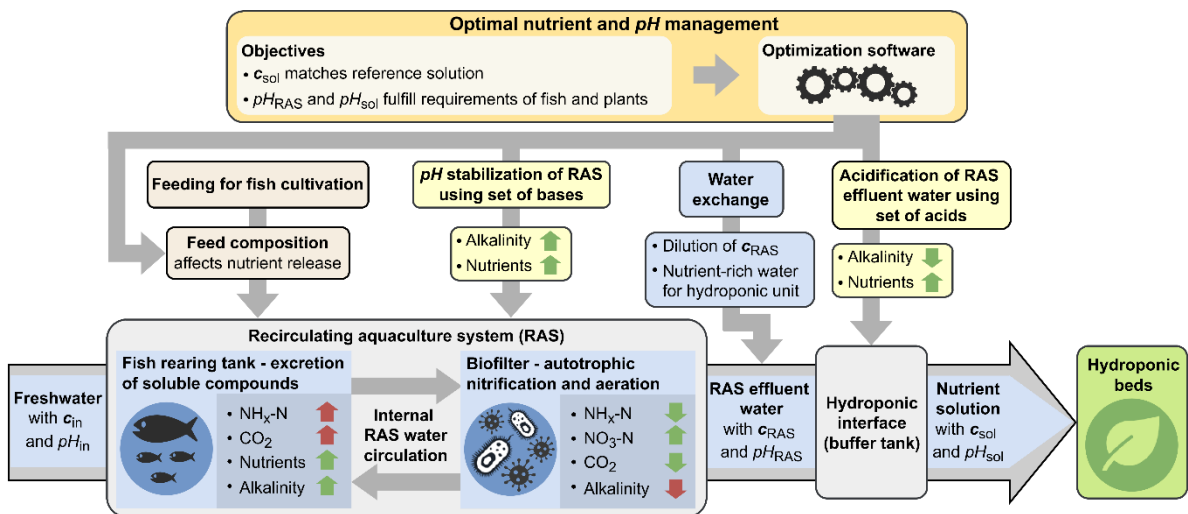


## Master Thesis / Research Project \*

# Design of an Interactive Decision Support System for Optimal System Balancing in Aquaponics

While aquaponics leverages the synergy between nutrient-rich aquaculture effluent and hydroponic crop demand, achieving a systematic balance remains a significant challenge. This research project/thesis is set to advance a recently developed optimization algorithm for on-demand coupled aquaponic systems. In its current state, the algorithm determines an optimal fish feed formulation combined with a suitable mixture of acids and bases for pH management to achieve a target nutrient profile in the aquaculture effluent.

This project/thesis seeks to extend the framework in two decisive directions. First, it shifts from the objective of a fixed reference profile to a system-level balancing approach, optimizing the specific composition of various plant species to match the variable nutrient output of the aquaculture unit. Second, to bridge the gap between theoretical modeling and practical application, the enhanced algorithm will be integrated into an interactive Decision Support System (DSS). This platform aims to empower practitioners to design highly efficient, resource-optimized aquaponic environments through an intuitive interface.



### Task description

- Analysis of a recently developed mixed-integer optimization problem
- Compilation of an approximate nutrient demand library for selected hydroponic crops
- Implementation and testing of extensions to the nutrient optimization algorithm
- Development of an open-source (e.g. python) graphical user interface for practical application

**Requirements:** Experience in optimization; Experience in python + MATLAB programming

**Start:** From 01.04.2026

**Contact:** [patrick.nestler@etit.tu-chemnitz.de](mailto:patrick.nestler@etit.tu-chemnitz.de), 2/W220

**What to expect:** During your research you can expect close guidance, while also maintaining freedom in how you approach the tasks. Through intermediate presentations you can prepare for your final defense and gather feedback from multiple team members throughout your project. The thesis can be written and supervised both in English or German, if your study regulations allow.