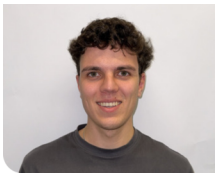
Flow Control of the Energy Valve for District Energy Applications

Development and Validation of Nonlinear Control Approaches

Graduate

Yanick Diggelmann



Gian Marco Näf

Definition of Task: BELIMO Automation AG is expanding its portfolio with solutions for modern thermal energy distribution systems.
The objective of this thesis is the development of a flow controller to enable fast and stable flow regulation.

The controller will be implemented on the existing control hardware of the "Belimo Energy Valve" product lineup.

Approach: The nonlinear valve characteristic, as well as the slow actuator response, represented the main challenge of this thesis.

Experimental measurements were performed on the Hydraulic Test Bench. The results enabled the development of a Matlab/Simulink model of the valve and actuator. This model then aided in the design and evaluation of several control strategies.

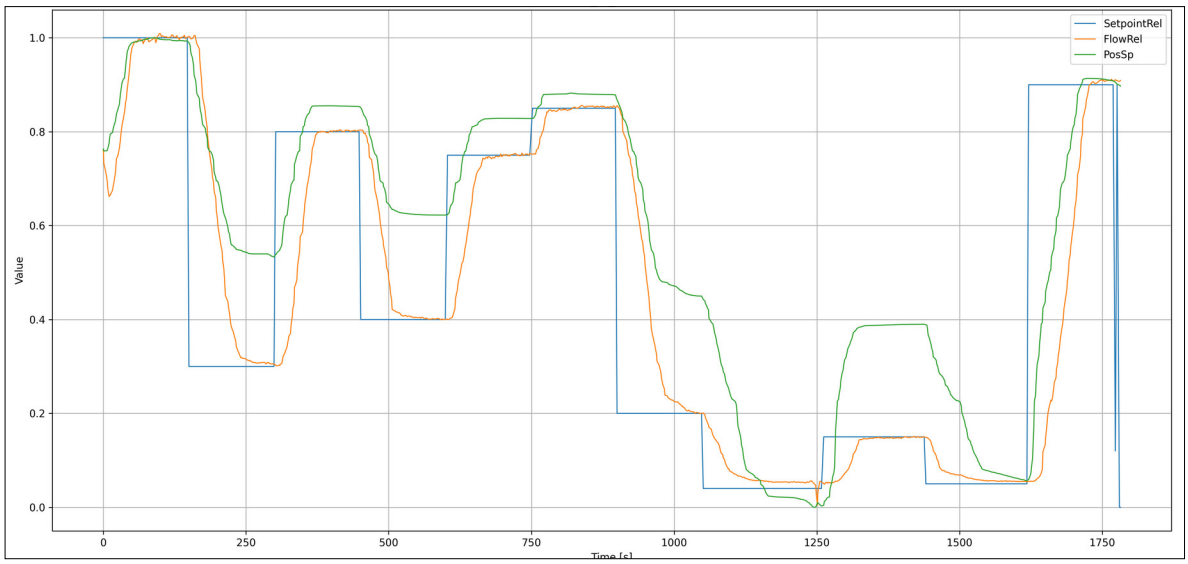
The investigated approaches include proportional (P), proportional–integral (PI), multi-point, gain-scheduled and feed-forward controllers, as well as combinations of these methods.

Conclusion: In the final phase of the project, multiple controller designs were validated experimentally on the Water Test Bench.
The investigated solutions demonstrated good performance in speed, accuracy and stability.

The Belimo Energy Valve
https://www.belimo.com/us/en_US/thermal-energy-meter

Water Test Bench with the valve, actuator and the Energy Valve controller
Own presentment

Experimental response of the control algorithm showing flow (orange), setpoint (blue), and actuator position (green).
Own presentment



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Subject Area
Regelungstechnik / Control Theory

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