HOCHSCHULE
RAVENSBURG-WEINGARTEN
UNIVERSITY
OF APPLIED SCIENCES

Simulation and Control of Heat Problems

Theses and Projects

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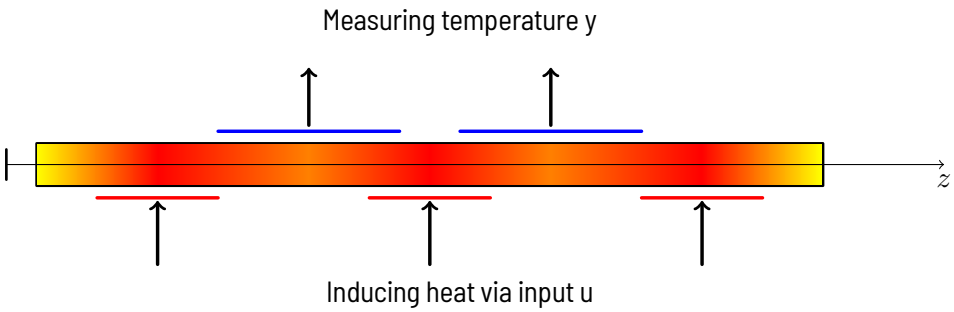

Many technological processes contain or depend on heat conduction and radiation. The temperature of components is crucial for their application: either it has to be reduced to guarantee a service (e.g. cooling of electronic devices) or it has to be increased to assemble or crack chemical components. Therefore, engineers are interested in modeling, simulating and controlling the temperature of certain components. However, problems like unknown or inexact material parameters occur and have to be solved using modern tools. An incomplete list of open tasks is:

- Modeling and Simulation of heat conduction via numerical methods
- Application of classical control methods (e.g. PID control, frequency analysis)
- Development of modern control techniques like Model Predictive Control
- Implementation of scientific machine learning methods

You will use software tools like JULIA or MATLAB® as well as further frameworks to develop **simulations**, **machine learning** and **control** algorithms. Please find details on the next page.

Selection of available topics

1. Implementation and evaluation of Optimal Control algorithms based on Scientific Machine Learning methods.
   See on GitHub: GalacticOptim.jl, DiffEqFlux.jl and ModelingToolkit.jl

2. Data-driven controller design for high-dimensional thermal dynamics using Dynamic Mode Decomposition.
   See on GitHub: DataDrivenDiffEq.jl

3. Convex optimization and development of fast methods for Optimal Control and Model Predictive Control.

4. Trajectory planning for a linear heat conduction model using flatness-based control.

5. Simulation with high-performance computing in Julia using multi-core and GPU programming.
   See on GitHub: CUDA.jl, MPI.jl

6. Accelerating numerical simulations of nonlinear and high-dimensional systems using Automatic Differentiation and next-generation numerical solvers.
   See on GitHub: DifferentialEquations.jl

Please contact me for specific tasks and questions.

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