Universität Stuttgart
Institut für Systemtheorie und Regelungstechnik
Prof. Dr.–Ing. Frank Allgöwer

Open Project (MA, Hiwi)

Robust quantum algorithm design

Description:

Quantum computing provides a promising alternative to overcome the limitations of classical computing and solve problems that were previously intractable. Recent years have seen significant progress in building larger quantum computers and developing algorithms that can potentially outperform classical ones. However, current quantum computers are limited by noise, which only allows for implementing small algorithms.
The design of quantum algorithms can be formulated as an optimal control problem for the *Schrödinger equation* $i\frac{\mathrm{d}}{\mathrm{d}t}\psi(t) = (H_0 + H_1 u(t))\psi(t)$ with state $\psi(t)$ and input $u(t)$. Noise can be modeled by letting $H_0(\Delta_0)$ and $H_1(\Delta_1)$ depend on uncertain and possibly time-varying parameters Δ_0 and Δ_1. Thus, designing robust algorithms for current quantum devices is, in fact, a robust optimal control problem.
It is the goal of this thesis to apply methods from robust or optimal control to study the robustness of existing quantum algorithms or design new algorithms which admit provable robustness guarantees.

Prerequisites:

- Strong background in control theory and mathematics
- Interest in theoretical problems
- **Lectures:** *Robust Control* or *Optimal Control* will be beneficial

Supervisor:

Julian Berberich
Room 2.235

Area:

Control theory
Quantum computing
Robust control

Properties:

Type: **MA, Hiwi**

30% literature
50% theory
20% implementation

Beginning:

now

Weitere Informationen: www.ist.uni-stuttgart.de/lehre/bama

Aushang vom 9. Februar 2023