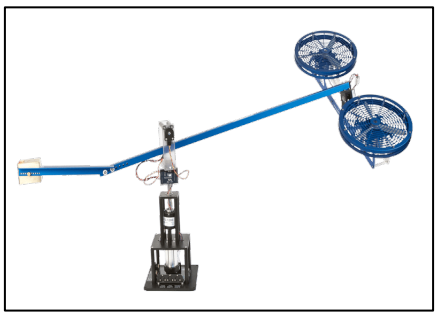
TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

INSTITUT FÜR MECHANIK UND MECHATRONIK
Mechanics & Mechatronics

Announcement Project- and Seminarworks

Deep Reinforcement Learning (Deep RL) for robust control of unstable systems – 3DOF Helicopter

Motivation and Content



3 DOF Helicopter ©Quanser

Technological advancements, particularly the continuous increase in computing power and the development of high-performance hardware have led to a growing significance of machine learning (ML) and reinforcement learning (RL) in recent years. The rapid progress in artificial intelligence (AI) is opening new possibilities for innovative applications across various fields – from robotics and autonomous control to the optimization of complex processes.

The goal of this project is to investigate the potential of reinforcement learning for controlling unstable systems, in particular the 3 DOF Helicopter (Quanser). A model-free RL algorithm will be developed and trained to stabilize the system effectively. In addition to configuring neural networks, various RL algorithms and agent types will be considered to determine the optimal control strategy. The project work aims to integrate a representative virtual environment in Simulink and the proof of concept that the simulative approach works.
The final evaluation will be based on relevant Key Performance Indicators (KPIs), including convergence speed, control quality, stability, and generalization capability, assessed through simulations.

Tasks

- Development and training of an RL agent for stabilizing an unstable system using various model-free algorithms
- Optimization of neural networks and simulation-based evaluation of different RL algorithms
- Comparison of RL agents in terms of training time, computational effort, and stability
- Analysis of results based on relevant KPIs (e.g., convergence speed, control performance)
- Documentation and presentation of results

Your Profile

- Successfully completed advanced courses in control engineering offered by E325
- Experience in laboratory work is an advantage
- Knowledge and understanding of reinforcement learning are beneficial

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