

Thesis: Development of a Custom Cooling System for QDD Actuators in Quadruped and Humanoid Robots

Simulation and Design

Advances in artificial intelligence and robotics are rapidly transforming how autonomous systems perceive, navigate, and interact with the world. A major component that makes these advances possible, is the emergence of high torque quasi direct drives (QDD), allowing for strong and dynamic movements simultaneously. However, these motors are limited by heat dissipation.

Basic Thesis Concept

The general goal of this thesis is to develop a custom QDD actuator cooling system for a quadruped/humanoid robot, that is currently developed at our institute (IMI). The cooling system should be developed based on thermal analysis of the actuator and validated in simulation, before setting up the physical system on a test rig.

Actuator Simulation

Thermal Analysis

- Identification of heat sources & flow paths
- Definition of relevant operating conditions and thermal requirements

Simulation & Design

- Simulation and optimization of the cooling system
- Selection and sizing of cooling components

Prototype & Test Rig

- Implementation of the cooling system on a test rig
- Experimental characterization of the system

Validation & Evaluation

- Validation of the thermal simulation with experimental results
- Evaluation of cooling efficiency and beneficial effects on motor performance



Skills

- CAD modelling (e.g. Fusion 360)
- CFD / thermal simulation
- Finite Element Analysis (FEA)
- Numerical simulation
- Electric motor / actuator fundamentals
- Sensor integration & temperature measurement
- Basic electronics
- Programming (Python, MATLAB/Simulink)
- (Not all of the listed skills are required from the beginning)

Do you want to work on cutting edge robotics research?

Type: Master Thesis

Date: As soon as possible

Supervisors: Prof. Dr.-Ing. Arne Rönau, M.Sc. Björn-Felix Dettmar

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We look forward to receive your application (inc. current grade transcript)!

