

## Bachelor's / Master's Thesis (m/w/d)

# Integrating Position Control and Tactile Feedback: Force Control of Shadow Hand Fingers Using a Cascade Controller

### Problem formulation

Precise force control is essential for delicate and complex manipulation tasks in robotic hands, such as the Shadow Hand. Traditional force control methods often struggle to achieve the necessary precision and responsiveness, mainly when relying solely on the force measurement in the tendons of the robotic hand. Integrating tactile fingertip sensors into a cascade control framework, where a force controller is layered within a position controller, could enhance the hand's ability to perform tasks requiring sensitive touch and controlled force application.

### Task definition

This thesis will investigate developing and implementing a cascade controller for force control in the fingers of a Shadow Hand. The research will focus on integrating a position controller with a force controller, utilizing tactile fingertip sensors to provide real-time feedback for closed-loop control. The effectiveness of this approach will be evaluated through a series of experiments designed to test the system's ability to perform precise and adaptive force control in various manipulation scenarios, emphasizing accuracy, stability, and responsiveness.



### You shall offer

- Solid knowledge base and experience in deep learning, and robotics.
- Coding skills in Python and C++.
- Experience with ROS
- Experience with control systems

### We will offer

- The most state-of-the-art technologies in deep learning and computer vision.
- Working in a lab with a Germany-wide unique Shadow Teleoperation System
- Tight support from supervisors, including a workshop on scientific writing.

### Research area:

AI & Robotics

### Focus:

- Experimental
- Theoretical
- Practical
- Simulation
- Construction (CAD)

### Study program:

- Maschinenbau
- Mechatronik
- Elektrotechnik
- Informatik
- Informationswirtschaft
- Wirtschaftsingenieurwesen

**Begin:** From now on

If you are interested, please send us an e-mail with your **curriculum vitae** and a current **transcript of records**.

### Contact person:

Edgar Welte  
Geb. 50.38; Raum 1.15  
Phone: +49 721 608 48645  
edgar.welte@kit.edu

Please note that your data will be treated in accordance with the applicable data protection regulations as part of the application process.