# Optimization and Biomechanics for Human Centred Robotics
# KIT BioRobotics Lab

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Endowed Chair by Hector Foundation II
Institute for Anthropomatics and Robotics (IAR)

## Master's Thesis: Implementation and investigation of robotic assistance strategies for helping people stand up and sit down.

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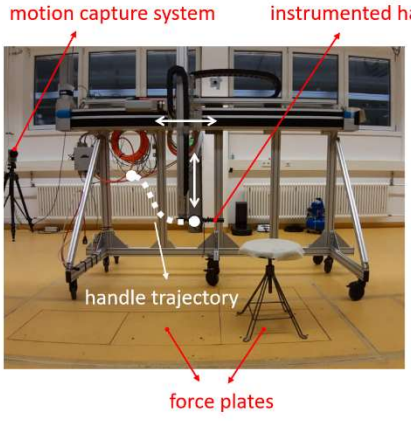
### Background

Standing up and sitting down are important daily living activities. Difficulties in performing these tasks, which affect particularly older adults, can impact quality of life (Riley et al., 1991; Jeyasurya et al., 2013). Robotic rollators and other robotic devices can help people stand up and sit down, but the best assistance strategies are still unknown (Geravand et al., 2023).

### Scope of the thesis

The thesis focuses on the investigation of different assistance strategies to help people stand up and sit down using a robotic assistance simulator (center and right of figure below). Each of the two robots has instrumented handle, whose motion is controlled by two motors. You will implement and test force- and/or impedance-control strategies to help people stand up and sit down, using the available actuators and sensors, and a Simulink control framework. The work involves some hardware implementation and programming in Simulink/Matlab.





### Required knowledge

This thesis requires basic knowledge in robotic hardware and control theory. Previous programming experience in Matlab/Simulink is desired but not obligatory.

### References

P. O. Riley et al., "Mechanics of constrained chair-rise," Journal of Biomechanics, 24, 1991,77–85.
J. Jeyasurya et al., "Comparison of seat, waist, and arm sit-to-stand assistance modalities in elderly population," Journal of Rehabilitation Research and Development, 50, 2013, 835-844.
M. Geravand et al., "A Survey on Rollator-Type Mobility Assistance Robots," in Handbook of Human-Machine Systems, Ed. John Wiley & Sons, 2023, 165-179.