

# Task Description

Master thesis

## Developing a control system for a Rehabilitation Robot's functionality

At the Institute for Medical device Technology (IMT), there is an availability of a master thesis, aiming at the design and development of a control system for a Rehabilitation Robot. An Ankle Rehabilitation Robotic System (ARRS) has been developed at the IMT, and this project entails the control system of the developed robotic system. The robotic system needs to ensure accurate and precise movement of the robot's joints and limbs to mimic human lower limb movements. Additionally, the control systems must include velocity control, trajectory generation, and therapy analysis and it needs to be able to modify the robot's control strategy based on the patients'/users' progress and goals. Data logging and analysis must be presented as well. As is seen below, Fig. 1 illustrates an ARRS, Fig. 2 illustrates a Robotic Trainer, and Fig. 3 illustrates a CAD model of a developed ARRS at IMT.



Figure 1: A spherical parallel ARRS, M. Malosio, et al.; 2012

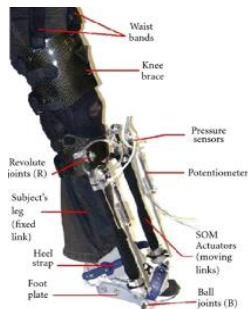


Figure 2: A Robotic Gait Trainer, W. Jeffery, et al.; 2007

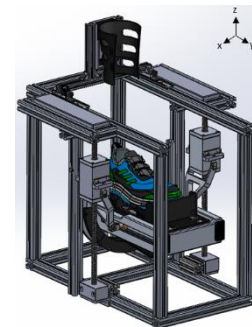


Figure 3: CAD model of a 2 DOF ARRS, SA 0253, P. Birchingner, IMT, University of Stuttgart, 2023

Aim of your thesis:

- to design and develop the control system in MATLAB/Simulink
- to test and validate the control system

The following requirements would be ideal for the prospective student:

- basic knowledge of microcontrollers, mathematical modeling, Control Theory and Programming
- basic knowledge of CAD (Creo Parametric)

Supervision will be provided in English. Hence, the thesis should be written in English.

In case of interest please contact P. Shah Nazar at [peiman.shahnazar@imt.uni-stuttgart.de](mailto:peiman.shahnazar@imt.uni-stuttgart.de)

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