University of Basel

Department of
Biomedical Engineering

BIROMED-Lab
Medical Robotics and Mechatronics

Master of Science – Biomedical Engineering
Thesis Proposal

Master's Thesis: Design of a Controller for an Over-actuated Cable-Driven Parallel Robot

Context: Cable-Driven Parallel Robots (CDPRs) are a specialized class of robotic manipulators that use flexible cables rather than rigid links to control the pose of an end effector[1,2]. Over-actuated CDPRs, characterized by having more actuated cables, are increasingly prevalent due to their inherent advantages in precision, accuracy, stability, and reliability.

For one of our existing CDPR with a novel mechanism architecture, the transition from a fully actuated system to an over-actuated system might improve the performance and reliability of the system. However, no specific controller for this architecture currently exists.

Task description: Your mission is to design a convex controller for our robot. You will subsequently test and compare the performance of the fully actuated and overactuated actuation strategies in terms of accuracy, precision, and, as a stretch goal, stability.

Nature of the Thesis
Experimental: 30%
Programming: 50%
Documentation: 20%

Specific Requirements
Passion for control technology and robotics.
Ideally, you followed LTI, Applied Control, or Robot Dynamics lectures.

Group Leader
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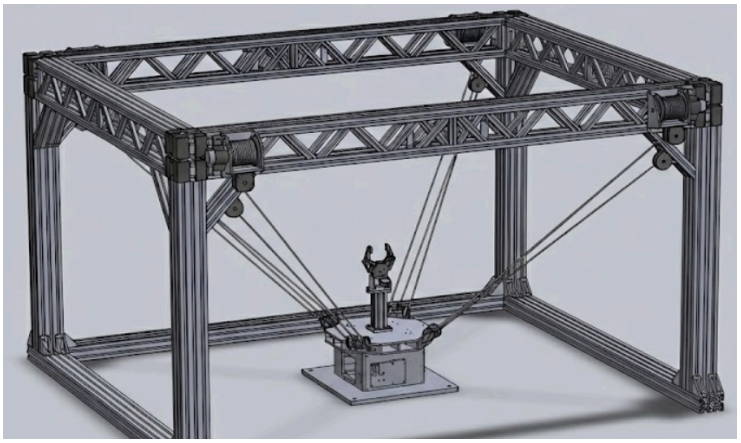

Figure 1: Artistic view of an cable-driven parallel robot.
Source: AI image generation

1 Joachim von Zitzewitz, Peter Wolf, Vladimir Novaković, Mathias Wellner, Georg Rauter, Andreas Brunschweiler, Robert Riener, Real-time rowing simulator with multimodal feedback, 2008, Sports Technology

2 Georg Rauter, Joachim von Zitzewitz, Alexander Duschau-Wicke, Heike Vallery, Robert Riener, A tendon-based parallel robot applied to motor learning in sports, 2010, Conference 2010 3rd IEEE RAS & EMBS International Conference on Biomedical Robotics and Biomechatronics

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