



Open Master Thesis Project

Miniature robot design analysis for accurate tool positioning in intraoral treatments

BIROMED-Lab

Department of Biomedical Engineering

The Bio-Inspired Robots for MEDicine-Laboratory (BIROMED-Lab) at the Department of Biomedical Engineering (DBE) at the University of Basel offers an exciting, multidisciplinary, and applied learning- and research environment. Our research is interdisciplinary and organized in close collaboration with clinicians and industrial partners.

Project background:

You will join the BIROMED-Lab performing medical robotics and mechatronics research under the lead of Prof. Dr. Georg Rauter. You will be part of the team for the project **Miniature Intraoral Robot (MIR) Performing Minimal-invasive, Personalized and Precision Dentistry**. In this project we aim to develop a robotic device for tooth preparation enabling a fully digital treatment workflow based on an innovative technology previously developed at the BIROMED-Lab.

Project description:

You will design and analyze a **miniature robot design for accurate tool positioning** that allows a milling instrument to move in three translational degrees of freedom. The main challenge will be the miniaturization of this tool positioning mechanism to fit inside the limited space available ($\approx 15 \text{ mm} \times 20 \text{ mm} \times 25 \text{ mm}$), to achieve high positioning accuracy ($\leq 50 \mu\text{m}$) and high load capacity required for milling. You will collaborate closely with the other project members and be part of a bigger team working on this robotic device to ensure that the mechanism you develop fits into the overall robotic device being analyzed. Your tasks will include:

- Analyze the requirements for the miniature tool positioning mechanisms
- Conduct research on existing positioning mechanisms and actuation principles that are applicable for the set requirements
- Select a promising positioning mechanism and an actuation principle and design a miniature positioning mechanism
- Analyze the kinematics and dynamics of the positioning mechanism and optimize the design with respect to the set requirements
- Evaluate the performance of the positioning mechanism with respect to the set requirements

Start date: November 2023 or upon agreement. You will work at the DBE located in the new SIP Basel Area main campus, an exciting and modern working environment in which various research groups of the DBE are located.

Your profile:

- You are pursuing a master's degree in mechanical engineering or a closely related discipline
- You have solid basics in mechanics
- You have experience in mechatronics
- You are a hands-on person who likes to work with hardware
- You are curious, motivated and self-driven
- You want to work in and contribute to an interdisciplinary and applied research environment

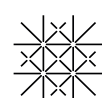
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- CV
- diplomas and course transcripts



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**University
of Basel**

Department of
Biomedical Engineering