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 (≈15 mm x 20 mm x 25 mm), to achieve high positioning accuracy (≤50 µm) 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](http://www.dbe.biomed.unibas.ch), 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

Ready to revolutionize dentistry? We are.

Apply for this project by email sending us (yukiko.tomooka@unibas.ch) the following materials:
- CV
- diplomas and course transcripts

Want to know more about us? check out [www.dbe.biomed.unibas.ch](http://www.dbe.biomed.unibas.ch) and contact us for a lab visit.