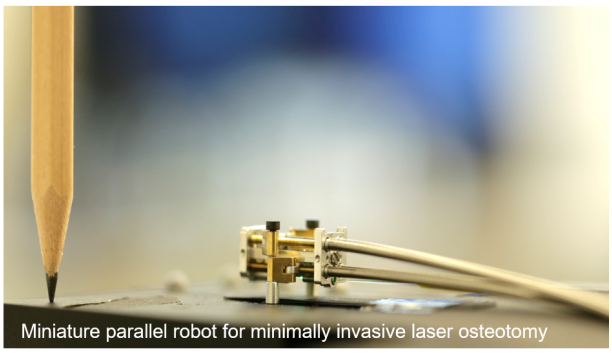
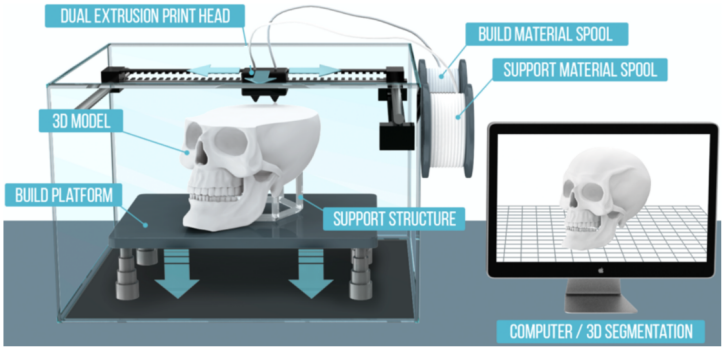
University of Basel
Department of Biomedical Engineering

BIROMED-Lab
Medical Robotics and Mechatronics

Master Thesis: Development of a minimally invasive 3D printing robot

Context: Minimally invasive surgeries, i.e., procedures with a minimal number and size of skin incisions, offer many benefits to the patient but are more challenging for surgeons to perform. Robotic systems with some level of autonomy can simplify their complex tasks during minimally invasive surgeries for the surgeons. We developed a miniature parallel robot with a precise motion for minimally-invasive robot-assisted laser osteotomy. Now we would like to expand the application of this robot to minimally invasive 3D printing.


Miniature parallel robot for minimally invasive laser osteotomy



Task description: In this project, the robot originally designed for minimally invasive robot-assisted laser osteotomy will be adopted for 3D printing. The goal of this thesis project is to build the first prototype of a miniature robot that can perform minimally invasive 3D-printing at the desired location inside the patient body.

Recommended work packages:

- Literature research: Literature research on state-of-the-art and theory of robotic 3D printing for medical applications will be conducted.
- Concept development: Concepts of the minimally invasive 3D printing robot based on the literature research and own ideas will be developed. The concepts will be evaluated with respect to the requirements found in literature.
- Prototype development and control implementation: A prototype of the robotic 3D printing system will be developed by adopting the miniature parallel robot originally designed for minimally invasive laser osteotomy. Control strategies required for the 3D printing systems will be implemented.
- Evaluation: Functionality of the prototype and the control strategy to its requirements will be evaluated.

Start: Feb 2022
Duration: 6 months

Supervision:
Yukiko Tomooka
Dr. Manuela Eugster
Prof. Dr. Georg Rauter

Contact:
Yukiko Tomooka (yukiko.tomooka@unibas.ch)
+41 61 207 54 66
https://biromed.dbe.unibas.ch