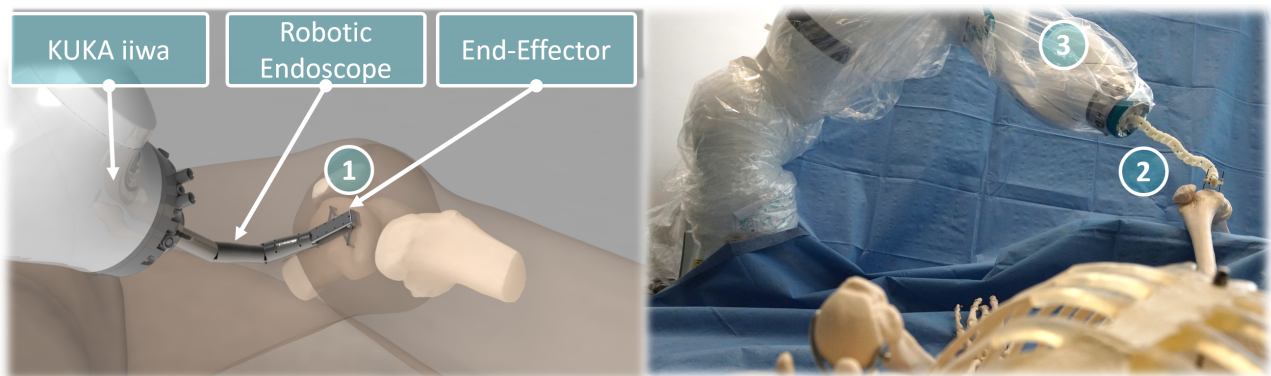


Semester Thesis: Design of a Flexible Endoscope Shaft for Laser Osteotomy in the Knee

Task description: In this project, you will support our interdisciplinary team in stabilizing and controlling the end-effector (1) of a robotic endoscope (2) which is guided by a serial robot (3). The aim of this thesis is the development of an actuated robotic endoscope with at least two degrees of freedom for unicondylar knee arthroplasty (UKA). During this work, you will mainly focus on the specific design of the flexible endoscope shaft. This device will be a key element in the realization of a new concept for end-effector positioning and stabilization which is based on a bone mounted parallel mechanism (Eugster et al. 2017, Hamlyn Symposium).



Your tasks:

- **Basic Research:** Literature research is conducted on existing designs of robotic endoscopes, in general and with special attention to the flexible endoscope shaft design, the corresponding manoeuvrability, integrated tool channels and the actuation principle. Strengths and weaknesses of different approaches are summarized.
- **Concept Development:** Working out the required degrees of freedom and workspace of the robotic endoscope with respect to the application in the knee (UKA). Determine the most promising concept for the structure of the flexible endoscope shaft, based on the conducted literature research.
- **Design and Analysis:** Design the flexible endoscope shaft. Develop the kinematics of the endoscope and simulate the resulting workspace.
- **Prototype and Evaluation:** Manufacture a prototype of the designed robotic endoscope in the workshop of the BIROMED-Lab. The actuation of the endoscope can be controlled manually due to the limited project duration. Test and evaluate the prototype and identify and documented further improvements of the design.

Start: October 2017, Duration: 14 weeks

Student:
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Professor ETH: Prof. Dr. Robert Riener

