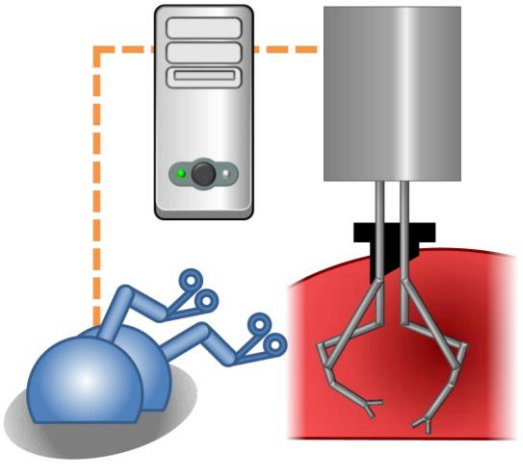
Technische Universität Berlin **Fachgebiet Mikrotechnik** **Prof. Dr. Heinz Lehr**

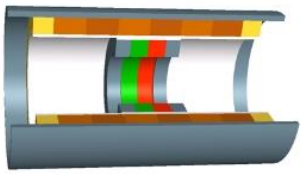
Mittwoch, den 3. Juni 2015 **15:00 Uhr bis 15:30 Uhr** **Hörsaal EW 115 A**

High-Dexterity Telemanipulation Robot for Minimally Invasive Surgery

Seminar lecture given by Dipl.-Ing. Sebastian Schlegel

For various types of surgery, a minimally invasive approach has become standard procedure. While there are distinct advantages to this technique, several drawbacks remain unsolved. A novel robotic telemanipulation system for single-port laparoscopy addresses these issues by offering great flexibility at the surgical site and an extremely compact design. The system's instrument arms are segmented and articulate within the abdominal cavity. They were designed to ensure stability while maintaining a small cross-section, thus keeping patient trauma to a minimum.





As high manipulation forces are required during surgery, strong actuators become necessary. Available space is extremely limited. Therefore, extensive research was conducted for finding suitable actuators. Several types of actuators as well as positions within the system were taken into account. Prototypes that were built and tested include fluidic muscles and electromagnetic linear drives. Depending on the actuator position within the system, mechanisms for transporting kinetic energy from the actuators to the joints are needed. Different approaches were examined, resulting in a solution highly adapted to the new surgical system.

Applying the results of this work, it was possible to build a telemanipulation system consisting of instrument arms, a support base, and a specifically designed user interface. A computer serves to calculate instrument trajectories and respective joint positions from the user input at the interface as well as to facilitate communication between the system's components.

The system exceeds previously defined goals concerning dexterity. Practical tests demonstrated the broad range of movement. At the same time, the extracorporeal components are considerably smaller than their counterparts in robotic surgical systems on the market, thus improving direct access to the patient during surgery. The complex kinematics of the instrument arms are controlled via a user interface designed for intuitive and precise handling.