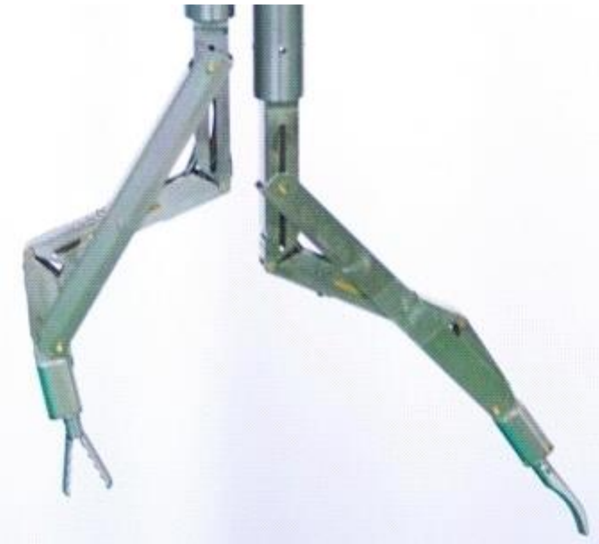
Technische Universität Berlin **Fachgebiet Mikrotechnik** **Prof. Dr. Heinz Lehr**

Donnerstag, den 04. Juni 2015 **16:30 bis 17:00 Uhr** **Hörsaal EW 115 A**

Workspace optimization of a surgical instrument for single port access surgery

Seminar lecture presented by Dipl.-Ing. Bastian Blase

Instruments for laparoscopic single port access surgery have to perform specific movements inside the human abdomen which enable surgeons to execute similar tasks they are familiar with from multi-port minimally invasive surgery. Therefore, branches of these instruments move apart before coming together at the surgical site to imitate an anthropomorphic position similar to standard access, thus facilitating handling at the desired target.



These movements require additional joints. Joints weaken an instrument's shaft structure and often lead to reduced strength, whereas parallel structures reduce workspace. Hence, instruments with a segmented planar hybrid parallel-serial mechanism have been developed, combining the advantages of both structures. This mechanism is coupled serially with an end-effector. Within a set of several geometric parameters and boundaries, the favored mechanism is optimized by varying the segments' lengths for maximizing a so-called area of dexterity comprising all points that can be reached within an angular range of at least 60°. This area can be described in a cylindrical coordinate system in a phase space composed of the radial tool tip position and its inclination. The different movements of the mechanism and the end-effector are superposed and the phase space is analyzed using image evaluation methods.

The optimized dexterous workspace by far exceeds a previously defined area of interest that was determined during in-vivo tests. The instruments based on this optimization proved to be agile in several tests like pick-and-place tasks.