During the last decade minimally invasive surgery has become the leading method for many surgical interventions. Unlike open surgery, minimally invasive surgery only needs small incisions in the patient's body. This leads to a drastic reduction of tissue trauma and therefore to shorter recovery times. In the beginning, this technique was performed manually with specialized instruments. Surgeons had to cope with restricted manipulability of the end-effector and poor visual feedback. These drawbacks were overcome by employment of dedicated robotic systems. We present an exhaustive overview on similar systems, both in research and for commercial use. Despite the advantages the systems offer, there are also needs of surgeons that have not been met. The most crucial issue is the lack of sensitive force feedback. This often leads to unpleasant side effects like damaging thread material or even lacerating healthy tissue. It is in particular this shortcoming that results in fatigue of the operator, due to visual compensation of the missing haptic feedback. Incorporation of force feedback in systems for robotic surgery is therefore a crucial factor in improving reaction to tissue contact. Our aim is to provide the surgeon with an operation environment very similar to manual instrumental surgery (i.e. the surgeon can always feel forces exerted on the instruments). Therefore we have developed the Endo[PA]R system, which we describe below in detail. Several experiments demonstrated the usefulness of this setup as an evaluation platform.
robotic surgery; minimally invasive surgery; force feedback