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PARASURG hybrid parallel robot for minimally invasive surgery

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Abstract
This paper presents the parallel hybrid robot, PARASURG 9M, for robotically assisted surgery, a robot which was entirely designed and produced in Romania. It is a versatile robot, being composed of a positioning and orientation module, PARASURG 5M with five degrees of freedom, having the possibility of attaching at its end either a laparoscope or an active surgical instrument for cutting/grasping, PARASIM, with four degrees of freedom. Based on its mathematical modelling, the first low-cost experimental model of the surgical robot has been built. The robot is part of the surgical robotic system, PARAMIS, with three arms, one used as a laparoscope holder, and other two for manipulating active instruments. When it is used as a manipulator of the camera, the user has the possibility to give commands in a large area for the positioning of the laparoscope using different interfaces: joystick, microphone, keyboard & mouse and haptic device. If the active surgical instrument, PARASIM, is attached, the robot commands are given through a haptic device. The main features that make the PARASURG 9M surgical robot suited for minimally invasive surgery are: precision, the elimination of the natural tremor of the surgeon, direct control over a smooth, precise, stable view of the internal surgical field for the surgeon. It also eliminates the need of a second surgeon to be present for the entire procedure (in the case of using the robot as a camera holder). In addition, there is improvement of surgeon dexterity in the case of using the PARASIM active instrument and better ergonomics in using the robot (in the case of the classic laparoscopy, the surgeon must adopt a difficult position for a long period of time, while the robot never gets tired). Having a relatively easy to understand, intuitive commanding system, the surgeons can rapidly adapt to the use of the PARASURG 9M robot in surgical procedures.
Key words: robotically assisted surgery, hybrid parallel robot, active surgical instrument, control system, simulation, interface

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