

# **Introducing the Sina<sub>flex</sub> as a robotic telesurgery system with flexible instruments**

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Abdominal surgery is one of the most areas of surgeries which motivated researchers to practically facilitate its methods through robotic-assisted surgery. Commercially available robots for this area of surgery, play a very important role in this way and nowadays there are more the 4000 installed robotic surgery systems all around the world and surgeons perform near 10% of abdominal surgeries using this kind of technology. However still there are several limitations on the way of using such a technology. The most important is the initial, consumable and maintenance cost of such a technology. Other limitations are lack of force feedback, limitations in design of architecture of surgery and portability of the machine.

This article briefly introduce Sina<sub>flex</sub> which is a robotic telesurgery system and designed to compete with currently available machines through several advantages at the mentioned limitations of other competitors. The Sina<sub>flex</sub> can be used for locally performing abdominal surgery operations in an ergonomic posture for surgeon and also remotely through internet or other communication channels. This system has two main subsystems including a master robotic console at the surgeon's side and a slave robotic system at patient's side with two or three surgical robots which are installed on the sides of a specific surgery bed. A robotic cameraman called RoboLens<sup>®</sup> is also integrated into the system to take the intra-abdominal images of the patient and send them to the surgeon's master console. The master robots receive the surgeon's hands movements and transmit them to the patient's side slave robots that mimic the surgeon's hand movements in a real-time manner. Simultaneously, the slave robots measure the robot and patient interaction forces/torques, including the pinch forces under instruments jaws and transmit them to the surgeon's side master robotic system. As a result, all tool-tissue interaction forces are fed backed to the surgeon's hands. The cameraman robot may be controlled through foot pedals from the surgeon's side or smartly track the surgery instruments with no need to any human control command. Other operating room equipment such as electro surgery device may be also remotely controlled from the surgeon's side master consol.

The Sina<sub>flex</sub> system has a reconfigurable surgery console. Using this system the surgeon may sit behind the surgery console and adjust it for the best ergonomic posture of him/herself. Also for long lasting surgeries which

surgeon may prefer to stand during surgery and reduced his fatigue, the console may be pre adjusted and reconfigured to standing posture with special ergonomic parameters of each specific surgeon.

Also, the Sina<sub>flex</sub> slave subsystem, has a modular design for placement of surgical robots, so surgeons may design their surgery architecture themselves by reconfigure the placement of surgery robots at one side or both side of surgery bed.

Using the Sina system, surgeon may use single or multiple use straight instruments for simple surgeries and also single use flexible instruments for more complex surgeries and through this way they may reduce the cost of surgeries. Figure 1 shows the the Sina<sub>flex</sub> system. The machine is under animal trials and shortly will start human trials to practically inter to the market of robotic-assisted abdominal surgery.



Figure 1. The Sina<sub>flex</sub> robotic telesurgery system