This project aims at improving haptic teleoperation performance of surgical robot with the presence of uncertainties (environment, measurement, robot mechanism, etc.) and relatively large disturbances caused by physiological motions of patients. The developed teleoperation architecture should be able to maximize the transparency of operation and the whole system should remain stable all the time for safety reasons. To this end, issues to be tackled have been identified from the basic to high level: (1) suppression of sensor measurement noises, (2) dealing with uncertainties in slave robot, (3) choice of interaction model between the robotic instrument and organ tissue and online parameter adaptation, (4) modeling of physiological tissue motion, (5) intelligent local control algorithms, (6) synthesis of haptic teleoperation system based on all aforementioned achievements. Research works have been done to address the aforementioned issues which involve quite some open problems in literature. Obtained results include intelligent slave robot control algorithms handling joint flexibility and actuator uncertainty which are common for light and small-sized medical robotic instrument, interaction model considering viscoelasticity property of tissue, 3D modeling methods with stereo vision, etc. Experimental studies are under work to verify obtained results and evaluating optimal solutions for certain tasks. The final synthesized system will go through lab test and animal experiment for validation of its effectivity.