

Development of Next Generation End Effector and Navigation System for Computer Aided Surgery

Takeyoshi Dohi

(Professor / Department of Mechano-Informatics, Graduate School of Information Science and Technology / The University of Tokyo)

【Outline of survey】

For the less invasive surgical therapy for the 21st century it is required to develop surgeon's "new eye" and "new hand" which is more advanced than ever. In this study, we develop "new hand", the next generation end effectors of high performance for surgical therapies by such a method that the surgical machines are more suitable than the surgeon: human. We develop bending mechanisms of high stiffness which are essential to such end effectors. We also develop devices which are mounted onto the bending mechanisms and by which therapies are performed not only mechanically but also physically using such as thermos and vibration and chemically using drags.

We establish methods of image processing necessary for 3D real image, wide view endoscope of small diameter, navigation system and therapy. We develop a display system for 3D full color videography by Integral Videography which is appropriate as a navigation tool in the next generation surgery. We develop wide view endoscope of 3 mm in diameter with wedge prisms which is inserted into all over the body and allows the observation of surgical field. We also develop chemical substance based marker which allows intra and postoperative diagnostics and observation.

【Expected results】

Three major causes of death in Japan, which accounts for 60 percent of the all, are cancer, cerebral vascular disease and circulatory system disease. Development of the next generation end effector and navigation system of high performance contributes to the surgeon friendly therapy for these diseases as well as the patient friendly one. The end effector and navigation system allow such a therapy for cardiac disease that the heart keeps beating during it, and reduce the risk of artificial heart lung which has been used in cardiac surgery with cardiac arrest in the procedure. They also allow the resection of next to 100 percent tumor in cerebral surgery and contribute to the exponential increase of 5 year survival rate.

Moreover it is promising to apply the end effector and navigation system to fetal surgery.

【References by the principal researcher】

(1)Hiromasa Yamashita, Takeyoshi Dohi, et al. A Handheld Laparoscopic Forceps Manipulator Using Multi-Slider Mechanisms. Journal of Japans Society of Computer Aided Surgery, Vol.5. No.4. pp421-427. 2004.

(2)Hongen Liao, Ichiro Sakuma, Takeyoshi Dohi, et al. Surgical Navigation by Autostereoscopic Image Overlay of Integral Videography. IEEE Transactions on Information Technology in Biomedicine. Vol.8. No.2. pp114-121. 2004.

【Term of project】 FY 2005 - 2009

【Budget allocation】 69,600,000 yen

【Homepage address】 <http://www.atre.t.u-tokyo.ac.jp/>