Novel Vibration Force Sensor with Hepatic Feedback for Minimal Invasive Surgery

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BACKGROUND

Minimally Invasive Surgery (MIS) in the form of laparoscopic surgery has dramatically increased in the last decade and has led to reduced access trauma in addition to providing significant benefits for the patient via better recovery times and cosmetics. Robotic Minimally Invasive Surgery (RMIS) has also increased in popularity. Both methods require haptic feedback (sense of touch) to be successful. Current haptic feedback methods for tele-operated surgical systems involve integrated force sensors that are difficult to miniaturize, nonsterilizable, nonversatile, delicate, and costly. Haptic feedback methods such as displacement sensors and resistive sensors have a variety of shortcomings. When force is applied to the structure, there is strain, thereby, causing the electrical resistance in the strain gauge to change. Both of these methods are not adaptable to the existing endowrist instruments, and require modifications to the endowrist. Moreover, these methods often involve a tradeoff between its function in measuring the magnitude and direction of force and its cost in manufacturing; inventions involving these methods are composed of delicate and complex parts dramatically increasing the cost.

TECHNOLOGY DESCRIPTION

Researchers at UC San Diego have created a Vibration Force Sensor that provides haptic feedback to the surgeon operating on tele-operated surgical systems during minimally invasive surgery.This feedback includes the magnitude and direction of force applied onto the end effector of the instrument. The Vibration Force Sensor can be attached to any tool head the doctor desires and is orders of magnitude less expensive than other force sensors. With this invention, the surgeon will be better aware of the interactive forces between the surgical tool and the patient's tissues and organs, thereby improving the safety and accuracy of the surgery.

APPLICATIONS

The Vibration Force Sensor can be used in many types of robotics and sensory applications. Particularly, the sensor can be used to give a sense of "touch" to robotic laparoscopic surgical arms. This allows the doctor to "feel" the environment around which they are operating. This invention can also be used on any structure with an anisotropic moment of inertia.

ADVANTAGES

- Attachable to any tool
- Less expensive than market alternatives
- Adaptable to existing endo-wrist instruments
- Most currently existing surgical robotic arms do not feature any haptic feedback

STATE OF DEVELOPMENT

A prototype has been developed

INTELLECTUAL PROPERTY INFO

A provisional patent has been submitted and the technology is available for licensing

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	0093560 A1	03/27/2020	2017-089
Patent Cooperation Treaty	Published Application	2018112041	06/21/2018	2017-089

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OTHER INFORMATION

KEYWORDS

Haptic feedback, tele-operated surgical systems, robotic surgery, robotic minimally invasive surgery

CATEGORIZED AS

- **Sensors & Instrumentation**
  - Medical
- **Engineering**
  - Robotics and Automation

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