CLAIMS

1. A handheld surgical instrument comprising:

a laser source configured to emit a laser beam;

a beam splitter configured to separate the laser beam to form a laser marker and a further laser marker on a surface;

an inertial measurement unit configured to detect a motion of the handheld surgical instrument and generate a first signal comprising information on the motion of the handheld surgical instrument detected by the inertial measurement unit;

a movable platform for holding a controlled tool tip;

an actuator mechanically coupled to the movable platform; and

a processing circuit configured to control the actuator to move the movable platform based on the first signal generated by the inertial measurement unit and a second signal generated by a vision unit based on a movement of the laser marker and a movement of the further laser marker, so that the movement of the movable platform holding the controlled tool tip at least partially compensates a tremulous motion of the handheld surgical instrument.

2. The handheld surgical instrument according to claim 1,

wherein the laser beam comprises visible light or infrared light.

3. The handheld surgical instrument according to claim 1 or claim 2,

wherein the laser marker is of any shape selected from a group consisting of a circular shape, a rectangular shape, a T-shape, and a cross shape.

4. The handheld surgical instrument according to any one of claims 1 to 3,

wherein the inertial measurement unit comprises one or more accelerometers for detecting the motion of the handheld surgical instrument.

5. The handheld surgical instrument according to any one of claims 1 to 4,

wherein the first signal comprises information on the motion of the handheld surgical instrument within a range of frequencies including a frequency of intended motion of the surgical instrument; and

wherein the second signal comprises information on the movement of the laser marker above a predetermined threshold, the predetermined threshold set above the frequency of intended motion of the surgical instrument.

6. The handheld surgical instrument according to claim 5,

wherein the processing circuit is configured to control the actuator to move the movable platform based on the first signal and the second signal so that the intended motion of the surgical instrument is uncompensated by the movement of the movable platform.

7. A surgical tool system comprising:

a handheld surgical instrument according to any one of claims 1 to 4; and

the vision unit.

8. The surgical tool system according to claim 7,

where the vision unit comprises:

a camera configured to detect the movement of the laser marker by converting an optical signal generated by the laser marker into an electrical signal.

9. The surgical tool system according to claim 8,

wherein the vision unit further comprises:

a surgical microscope configured to magnify laser marker.

10. The surgical tool system according to claim 8 or claim 9,

wherein the vision unit further comprises:

a computer configured to receive the electrical signal from the camera;

wherein the computer is further configured to determine a centroid of the laser marker; and

wherein information on the movement of the laser marker is information on a movement of the centroid of the laser marker.

11. The surgical tool system according to claim 10,

wherein the computer is configured to generate and transmit the second signal to the processing circuit of the handheld surgical instrument;

wherein the computer is further configured to filter out the movement of the laser marker at or below a predetermined threshold, so that the second signal comprises information on the movement of the laser marker above the predetermined threshold; and

wherein the predetermined threshold is set above a frequency of intended motion of the surgical instrument.

12. The surgical tool system according to claim 11,

wherein the first signal comprises information on the motion of the handheld surgical instrument within a range of frequencies including the frequency of intended motion of the surgical instrument.

13. The surgical tool system according to claim 12,

wherein the processing circuit is configured to control the actuator to move the movable platform based on the first signal and the second signal so that the intended motion of the surgical instrument is uncompensated by the movement of the movable platform;

preferably wherein the processing circuit is configured to generate an output signal based on the first signal and the second signal, the output signal excluding frequencies at or below the predetermined threshold; and

wherein the processing circuit is configured to control the actuator to move the movable platform based on the output signal.

14. A method of forming a handheld surgical instrument, the method comprising:

providing a laser source configured to emit a laser beam;

providing a beam splitter configured to separate the laser beam to form a laser marker and a further laser marker on a surface;

providing an inertial measurement unit configured to detect a motion of the handheld surgical instrument and generate a first signal comprising information on the motion of the handheld surgical instrument detected by the inertial measurement unit;

providing a movable platform for holding a controlled tool tip;

mechanically coupling an actuator to the movable platform; and

electrically connecting a processing circuit to the actuator, the processing circuit configured to control the actuator to move the movable platform based on the first signal generated by the inertial measurement unit and a second signal generated by a vision unit based on a movement of the laser marker and a movement of the further laser marker, so that the movement of the movable platform holding the controlled tool tip at least partially compensates a tremulous motion of the handheld surgical instrument.