3-D-Micro Force Sensor
for heart catheterizations

Topic

For the treatment of arteriosclerosis, a guide wire is inserted through a leg artery into the heart vessel, where the narrowed artery is widened with a balloon dilatation. To avoid complications, with the assistance system HapCath the force vector at the guide wire tip is measured. This force is amplified and fed back onto the guide wire with the aid of actuators.

Solution

Design and fabrication of highly miniaturized piezoresistive force sensors with silicon bulk micro-machining technology. Advantages are high miniaturizability, nearly punctual measurement of the distribution of mechanical stress, large resistive signal span with high linearity and also cost effective batch fabrication. These advantages lead to cheap sensor elements, which are currently the smallest force sensors available for measuring a force vector.

Characteristics

- Geometry: 200µm•200µm•630µm
- Nominal Force: \( F_N \approx 150 \text{ mN} \)
- Overload Resistance: \( F_{\text{max}} \approx 1000 \text{ mN} \)
- Resolution: \( A < 0.1 \text{ mN} \)
- Linearity Error: \( F_{\text{Lin}} < 1\% \)
- Frequency range: static up to 100 kHz

The sensor are packaged with biocompatible material and integrated into guide wires. The current work is focussed on the reliability of the overall system "Haptic Guide Wire" and the reproducible calibration of the 3D-force vector.

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