CAPACITIVE FORCE SENSOR AND FABRICATION METHOD

Reference No. B72026

CHALLENGE

The accurate sensing of forces on surfaces of equipment such as robots, mobile phones and industrial machines is one of the central tasks of designers of human-machine interfaces. Currently used sensor cells use a variety of physical effects to convert forces acting on surfaces in locally measurable physical quantities. In addition to capacitive methods mostly resistive methods dominate the market. Challenges in producing such cells and accurately measuring the sensor forces due to hysteresis or limited bandwidth restrict the range of use of such sensor cells.

INNOVATION

The novel force-/pressure sensor is based on the principle of capacitive measurement of the deformation of a plate capacitor without using an otherwise conventional interlayer dielectric medium. The sensor essentially consists of two main parts, a round capacitor plate (bottom) coated with solder resist and a capacitor cap (top) that can be precisely superimposed on each other at a distance of only 50 microns to achieve a large capacity in spite of the absence of a dielectric in the resulting capacitor gap, which is a prerequisite for a good resolution of force curves. The upper side of the load bearing plate of the sensor (capacitor cap) consists of high-strength beryllium copper to ensure endurance and high pressure resistance. Overall, the sensors are the size of a pencil head. Advantages for manufacturing:

- Absence of any dielectric material in the capacitor gap eliminates the need to adapt alignment and bonding processes
- No cable connection needed due to novel attachment pads
- Use of capillary forces in the liquid solder enables automatic spacing and orientation control of the capacitor plates

Because of these advantages force sensors can now be applied to printed circuit boards or other, possibly flexible, substrates efficiently and precisely while ensuring durability and compact arrangement. Several thousand sensors can be evaluated per second in order to create a surface contact profile.

COMMERCIAL OPPORTUNITIES

The invention is suitable for numerous applications in industry, be it level gauges for liquid reservoir, smart buttons for consumer electronics or receptor surfaces for robotics acting as artificial skin.

DEVELOPMENT STATUS

Prototype

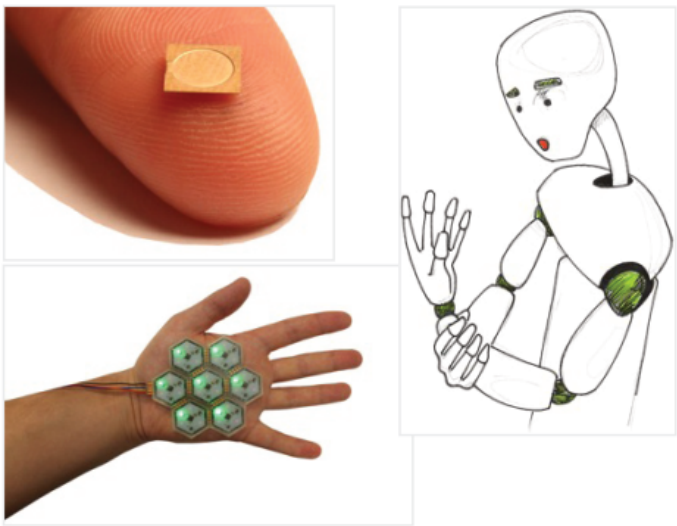

Figure: Force Sensor (Source: Philipp Mittendorfer)

REFERENCES: EP 2677291

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