Visions to Products

2-axis Inclination Sensor
High Resolution Inclination Measurement

Inclination sensors can be used to detect the tilting or inclination of machines or objects relative to the horizontal.

The 2-axis inclination sensor is the consequent improvement of the capacitive 1-axis ±90° and ±180° inclination sensor developed at Hahn-Schickard in 2006 and transferred to 2E mechatronic in 2009 for industrial production. This capacitive sensor is based on a stack of three printed circuit boards (pcb) to form a cavity that is filled with a dielectric fluid. Together with electrodes on the top and bottom pcbs a differential capacitor delivers tilt sensitive capacitances with a resolution of ±0,01° in a temperature range of -40 … +85°C.
This existing sensor concept was extended. Based on a printed circuit board with 4 electrodes on top connected as a differential pair of electrodes with a copper dome as a shared electrode, two differential capacitors form a cavity that is filled with a dielectric fluid. A small air bubble remains, moving along the surface of the dome depending on the inclination angle.
This gives a differential position signal of the air bubble inside the sensor cell that is only 24 mm in diameter.

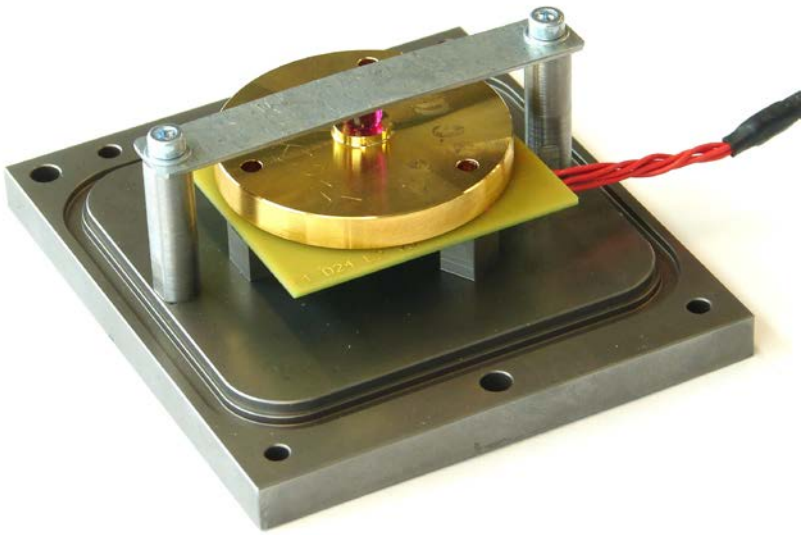

Fig. 1: Sensor demonstrator without cover

Sensor Features

- PCB sensor
- Range: ±2° in two axis
- Resolution: up to <2 µm/m
- Repetition rate: variable
- Sensor cell: Ø 24 mm

Field of application

- Precision nivelling of machines
- Geological Measurements
- Condition monitoring of bridges, buildings and off-shore windparks

The radius of the dome was optimized to deliver a nearly linear signal. Beyond that range the bubble touches the border of the dome and warps, still giving a change in capacitance.
For mechanical fixation the diameter of the dome is increased to create a determined mounting situation of the sensor cell inside the enclosure.
A commercial capacitance-to-digital-converter (CDC) as single chip is used to measure the differential capacitances and allows temperature compensation, linearization and several analog and digital interfaces such as analog voltage, PWM, PDM, I²C or SPI.

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