ESP1844

Flexible Micro displacement Sensor for Wearable/Implantable Biomedical Applications

Wireless monitoring systems are becoming a popular technology in non invasive diagnosis. Based on current technological trends, low-power consumption, flexibility, small size, disposability, and low cost are the most important parameters to consider when designing sensors for biomedical applications. Echoing this trend, this paper presents a flexible wearable/implantable biocompatible sensor using wireless passive detection scheme, for future studying of the dynamics of an implanted abdominal mesh. Recording information about mechanical behaviour of the implanted mesh helps in understanding hernia recurrence, among other post-surgical problems. Micro fabricated sliding inter digitated gold plates and a circular coil (parallel inductor-capacitor tank) on a flexible substrate constitute the sensor's main core. The capacitance and, in consequence, the resonant frequency of the sensor will vary according to the sliding magnitude, because the overlapping area between the inter digitated plates changes on sliding. Thus, the monitored resonant frequency is the sensor response. Different thicknesses cyclo-olefin polymer was used as a dielectric layer. Phantom was used to the ex vivo characterization of tissue behaviour. The capacitor was tested in a 0-600 µm displacement's range. The measured sensitivity was 0.04 and 0.85 pF/50 µm in simulated conditions, with a resolution of less than 1 µm. The maximum sensitivity in the frequency range was 410 kHz/ 50 µm. The frequency shift can be detected by an external readout coil up to 20 mm in air and 10 mm in phantom. The experimental results confirm the scalability of the sensor.

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