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SELF-SENSING IPMC ACTUATING DEVICE WITH PATTERNED SURFACE ELECTRODES

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IPMCs (ionic polymer-metal composites) are a type of electroactive materials that consist of thin polymer (*e.g.* Nafion) sheet covered with metal (*e.g.* Platinum) electrodes on both sides. When IPMC strip is placed in a cantilever configuration and voltage is applied to the electrodes, IPMC bends – this process is called actuating [1]. There exists two ways for using IPMC strip as a sensor. First, a conventional way, while IPMC is being externally bent a small current is generated between electrodes [2], and the second method is to measure the change in resistance of surface electrodes, as it is correlated to the curvature of IPMC actuator [3].

The concept of self-sensitivity of an actuator refers to the possibility to exploit its sensory properties (despite the background phenomena) for acquiring feedback signals on the produced action. The sensor signal can hence be used for closed-loop control of the actuator.

It is proposed to pattern an IPMC in such a way that both actuator and sensor are on the same strip of material (Fig. 1), thus creating a device that can be considered as self-sensing [4]. In current configuration, resistance change along the sensor electrode is measured. To overcome problems due to cross-talk from actuator to sensor, an additional shielding electrode is patterned between the sensory and actuating parts of IPMC (Fig. 1) [4].

Fig. 2 depicts signals acquired respectively from laser displacement sensor and sensing element of proposed actuating device. Clear correlation of these two signals can be seen.

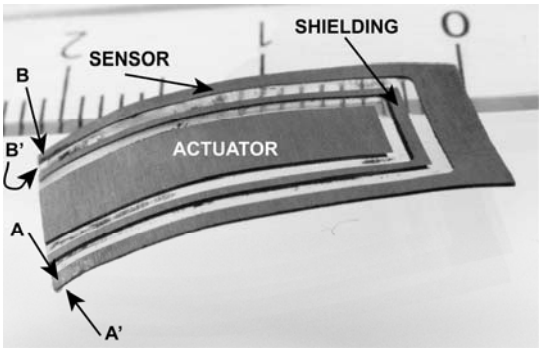

Fig. 1. Pattern on the surface of an IPMC strip [4].

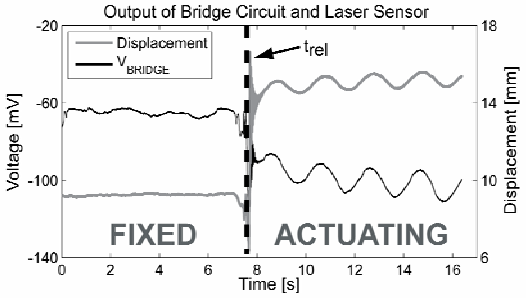

Fig. 2. Outputs of the IPMC sensing element (V_{BRIDGE}) and the laser displacement sensor [4].

References

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