Active sensing methods of ionic polymer metal composite (IPMC) : Comparative study in frequency domain

Mohdisa, Wanhasbullah[a, b] *; Hunt, Andres*[a]*; Hosseinnia, S. Hassan*[a]

[a] Department of Precision and Microsytems Engineering, Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Delft, 2628 CD, Netherlands

[b] Faculty of Manufacturing Engineering, Universiti Malaysia Pahang, Pekan, Pahang, 26600, Malaysia

ABSTRACT

Ionic polymer-metal composites (IPMCs) are soft transducers that bend in response to low-voltage input, and generate voltage in response to deformations. Their potential applications include compliant locomotion systems, small-scale robotics, energy harvesting and biomedical instrumentation. The materials are inherently compliant, simple to shape, simple to miniaturize and simple to integrate into a system. Compared to actuation, IPMC sensing has not been intensively studied. The existing reports focus on the sensing phenomenon, but provide insufficient characterization for implementation purposes. This work aims to address this gap by studying and comparing the frequency responses and noise dynamics of different IPMC active sensing signals, i.e. voltage, charge and current. These characteristics are experimentally identified by mechanically exciting IPMC samples, and simultaneously measuring the respective signals and material deformations. The results provide a systematic comparison between different implementations of active sensing with IPMCs, and give insights into their strengths and limitations.

KEYWORDS

Deformation; Energy harvesting; Frequency response; Organic conductors

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