Special Issue

Smart Materials and Structures for Advanced Sensors and Actuators in Robotics and Human–Machine Interface

Message from the Guest Editors

The ever-increasing market value of robotics and human–machine interface (HMI) necessitates the rapid development of innovative sensors and actuators with unprecedented performance. For sensors in particular, higher spatial and temporal resolutions and lower detection thresholds are required. In the meantime, novel actuators must possess high force/energy output with reduced energy consumption and weight for energy efficiency and compactness. These challenges can be overcome by integrating sensors and actuators with smart materials and structures to maximize these performance metrics. For instance, various types of stimuli-responsive materials, including hydrogels, shape memory alloys/polymers, piezoelectric materials, dielectric materials, and triboelectric nanogenerator (TENG) materials, exhibit promise as advanced sensors in electronic skin (E-skin). In addition, the utilization of smart structural designs, including mechanical metamaterials, mechanical multi-stability and instability, can significantly enhance the performance of actuators in soft robotics and haptics.

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