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Technical programme

Book of abstracts

List of participants

recreated the shape configuration measured in the experiments. This approach helps to formulate novel design parameters to improve the development of dielectric elastomer actuators.

2.2.9 Dielectric elastomer based prototype of a mechanically resonating inchworm-like robot with unidirectional claws

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Presentation given by Mr. Luigi Calabrese

We present a proof-of-concept where a robot, actuated via a Dielectric Elastomer Actuator (DEA), simultaneously exploits both vibration and inchworm locomotion to move. The robot consists of an assembly of three components: a plastic beam able to store elastic energy upon deformation, a planar DEA and four clawed pads featuring asymmetric rigid steel bristles. In order to accumulate elastic energy, the thin plastic beam is highly bent upon assembly so that when coupled to the DEA, it composes a self-standing structure. From this configuration, owing to the capability of the DEA to

elongate upon application of a driving voltage V, we show that it is possible to increase the length of the structure when the voltage V is applied and to return to the original length when the voltage V is removed. In this way, by opportunely modulating the voltage, it is possible to exploit the asymmetric orientation of the bristles to trigger the unidirectional stick-slip locomotion of the robot. The fundamental frequency of the robot was estimated by using the Rayleigh method and locomotion tests were carried out at that frequency. We observed that when the actuation frequency of the DEA was close to the fundamental frequency of the structure, the measured locomotion speed exceeded by 25% the theoretical speed (calculated as the free stroke of the actuator times the actuation frequency), revealing the presence of a forward sliding triggered by the dynamic effects due to the resonance.

2.2.10 Ionic EAP actuators in minimally invasive healthcare products

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Presentation given by Prof. Alvo Aabloo

At various times during the medical process, invasive procedures can be applied to the patient either for diagnostic or therapeutic reasons1. There is a global trend towards diagnostic and interventional medical devices become less invasive and the number of invasive procedures that are being replaced by non-invasive ones is increasing steadily over time. This results in a need for smaller devices with increased manoeuvrability in many types of minimally invasive devices such as for instance needles, endoscopes, endovascular devices and minimally invasive surgical tools. Ionic electroactive polymer (iEAP) actuators are a promising class of materials for soft robotics and biomedical applications. An iEAP bends in response to electrical stimuli and can be controlled remotely via the electrical input. Furthermore, iEAP actuators are soft and easily miniaturized, which makes them promising materials for actively navigating inside the body, especially inside complex and delicate blood vessel networks where vessels have a diameter of less than 1 mm. Here we show miniaturized compliant carbon-based iEAP actuators that could be applied in minimally invasive devices for active navigation. We anticipate this to be a good starting