Braille Code Matrix

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Abstract : According to the world health organization (WHO), there are almost 285 million people with visual disability, 39 million of these people are blind. Nevertheless, there is a code for these people that make their life easier and allow them to access information more easily; this code is the Braille code. There are several commercial devices allowing braille reading, unfortunately, most of these devices are not ergonomic and too expensive. Moreover, we know that 90 % of blind people in the world live in low-incomes countries. Our contribution aim is to concept an original microactuator for Braille reading, as well as being ergonomic, inexpensive and lowest possible energy consumption. Nowadays, the piezoelectric device gives the better actuation for low actuation voltage. In this study, we focus on piezoelectric (PZT) material which can bring together all these conditions. Here, we propose to use one matrix composed by six actuators to form the 63 basic combinations of the Braille code that contain letters, numbers, and special characters in compliance with the standards of the braille code. In this work, we use a finite element model with Comsol Multiphysics software for designing and modeling this type of miniature actuator in order to integrate it into a test device. To define the geometry and the design of our actuator, we used physiological limits of perception of human being. Our results demonstrate in our study that piezoelectric actuator could bring a large deflection out-of-plain. Also, we show that microactuators can exhibit non uniform compression. This deformation depends on thin film thickness and the design of membrane arm. The actuator composed of four arms gives the higher deflexion and it always gives a domed deformation at the center of the deviceas in case of the Braille system. The maximal deflection can be estimated around ten micron per Volt (~ 10µm/V). We noticed that the deflection according to the voltage is a linear function, and this deflection not depends only on the voltage the voltage, but also depends on the thickness of the film used and the design of the anchoring arm. Then, we were able to simulate the behavior of the entire matrix and thus display different characters in Braille code. We used these simulations results to achieve our demonstrator. This demonstrator is composed of a layer of PDMS on which we put our piezoelectric material, and then added another layer of PDMS to isolate our actuator. In this contribution, we compare our results to optimize the final demonstrator.
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