Design and Simulation of Printed Force Sensitive Resistor for Wearable Electronics

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Abstract

The growing demand of wearable electronics has motivated the development of printed force sensitive resistors that are flexible. Force sensitive resistors (FSRs) provide a promising solution as piezoresistive force sensors to sense force or pressure for wearable devices. The FSR shows a decrease in resistance when force is applied to the active surface area which has good potential application for flexible and wearable electronics. However, limited previous work studied on the finite element analysis to predict the change of resistance after sensing for the optimization before proceeding to the fabrication. Hence, this study aims to design and simulate a printed FSR for the optimization of design before proceeding to the fabrication of the printed sensor. Three important design parameters such as force applied, gap spacer height, and the electrode ratio were reported in this work. Finite element simulation results show the force applied onto the FSR can decrease its

resistance until it reaches the minimum resistance value. As the gap spacer height increased, the minimum resistance value at a certain force also decreased. The electrode ratio (width of electrode/gap between electrodes) also influenced the maximum resistance drop of the FSR due to electrodes contacting the piezoresistive layer more evenly. The optimum parameters that were chosen in this work are the gap spacer height at 0.02 mm and electrode ratio (width of electrode/gap between electrodes) at 0.67. The simulation results in this work demonstrated that the height of gap spacer and the electrode ratio can influence the sensitivity of the FSR. © 2025 IEEE.

Author keywords

electrode ratio; finite element simulation; Force Sensitive Resistor; gap spacer height; piezoresistivity; Printed electronics; wearable electronics

Indexed keywords

Engineering controlled terms

Electrodes; Nanotechnology; Printed circuit design; Resistors; Surface resistance; Thermoelectricity; Wearable sensors

Engineering uncontrolled terms

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Engineering main heading

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