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Numerical Investigation Including Mobility Model for the Performances of Piezoresistive Sensors

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Abstract : In this work, we present an analysis based on the study of mobility which is a very important electrical parameter of a piezoresistor and which is directly bound to the piezoresistivity effect in piezoresistive pressure sensors. We determine how the temperature affects mobility when the electric potential is applied. For this, a theoretical approach based on mobility in a p-type Silicon piezoresistor with that of a finite difference model for self-heating is developed. So, the evolution of mobility has been established versus time for different doping levels and with temperature rise provoked by self-heating using a numerical model combined with that of mobility. Furthermore, it has been calculated for some geometrical parameters of the sensor, such as membrane side length and thickness. Also, it is computed as a function of bias voltage. It was observed that mobility is strongly affected by the temperature rise induced by the applied potential when the sensor is actuated for a prolonged time as a consequence of drifting in the output response of the sensor. Finally, this work makes it possible to predict their temperature behavior due to self-heating and to improve this effect by optimizing the geometric properties of the device and by reducing the voltage source applied to the bridge.

Keywords : Sensors, Piezoresistivity, Mobility, Bias voltage
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