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(57) Abstract :
High-voltage breakdown, abrupt voltage variations, and partial discharge issues are common in industrial installations that use high-voltage direct current for power production, transmission, and control. When the aforementioned circumstances exist, a detectable electric field is generated nearby, reflecting the systems' current state of health. For safe and efficient operation under these circumstances, detecting the ambient electric field is a must. Despite the many approaches that have been offered for detecting electric fields, most of them are limited by issues including poor resolution, limited dynamic range, complicated design, slow reaction time, and vulnerability to interference. However, assuring optimum design with high resolution and cheap cost has remained a difficulty, even though piezoresistive materials and piezoelectric field-based Micro-electromechanical sensors (MEMS) have demonstrated substantially improved performance in linear-temperature stability and sensitivity. Most state-of-the-arts are developed for prospective assessments in the great outdoors, but these environments lack the clutter, interference, and noise that are common in industrial ecosystems. This research offers a MEMS-based electric field sensor that is operated by a piezoresistive spring suspension for use in industrial health monitoring. The suggested MEMS sensor has an ion-doped piezoresistive spring structure, a Single Crystal Si suspension electrode, and a SiO2 insulation beam. This technique makes advantage of the deflection in the suspension electrode brought about by the electrostatic force created at the fixed electrode to calculate the electric field in the area. Strain in the piezoresistive spring arrangement and body mass displacement are the results of providing a high voltage at the fixed electrode and grounding the suspension electrode (upward). The electric field in the area is calculated based on the magnitude of this displacement. The suggested MEMS sensor is small, easy to construct, and inexpensive since it is developed in the dimensions of 5 μm×1μm×5 μm.

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