MEMS Sensors for Load Cells Applications

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Abstract

Systems for force measurement are genuinely integrated in our everyday life and a number of new applications are introduced to the market regularly. The areas vary between: entertainment, household, automotive, industrial, scientific, and many other application. Traditionally, thin film strain sensors have been used for force sensing in above mentioned systems for decades. Various sensors with different layouts, configurations and specs ranging from simple and universal to highly sophisticated and application-specific, have been developed and they are on-shelf available.

Simultaneously and modulated by the specs of strain sensors, a huge progress in design and performance of transmission mechanisms has been achieved. In synergy industrial design and additional functionalities became a must to provide successful market acceptance of force measuring systems.

Piezoresistive devices are in the list of potential candidates strain measurement sensors, due to their linearity, high value of the gauge factor and compatibility with standard IC manufacturing processes. But simultaneously, disadvantages like high thermal sensitivity, noise/signal level, drift and relatively high manufacturing costs, prohibited their successful exploitation in many of the above mentioned applications.

As an attempt to meet both: the advantages of piezoresistive force sensors and specifications of various force sensing systems, series of correlated problems have been solved. This paper presents recent results obtained in experimental characterization and design optimization of MEMS piezoresistive sensors in respect of force measurement applications. It was experimentally shown that due to dedicated design and specific fabrication technologies used for the mentioned sensors, the performance of piezoresistive devices is not any longer suffering of the above mentioned disadvantages and new application frontiers are found. Record high sensitivity and dynamic range have been demonstrated.

Co-related to optimized MEMS devices, design and fabrication optimization of relevant transmission mechanisms will be implemented in future research.

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