

“Design and Analysis of MEMS Accelerometers”

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In recent years, micromachined inertial measurement units (IMUs) have gained a significant amount of attention due to an increased interest in the development of in-doors portable navigation systems (PNS). The introduction of MEMS gyroscopes to the consumer electronics market enabled the integration of multi-degree-of-freedom (multi-DOF) systems in cellphones, tablets and other hand-held devices, but most motion-sensing applications are limited to coarse movement detection, such as gaming. In order to achieve navigation-grade performance, the resolution, dynamic range and bandwidth of commercially available accelerometers and gyroscopes have to improve, without compromising the size and cost benefit offered by MEMS technology.

In this tutorial, the latest advancements in accelerometer design and development will be presented. A brief overview of conventional static acceleration sensors will be covered, followed by details on the advantages and challenges of device scaling. New techniques such as low-vacuum operation, high-frequency design, and tri-axial monolithic implementation, will be described in the frame of multi-DOF systems. Lastly, developments on the implementation of self-test and calibration methods for of accelerometers will be summarized to highlight their importance in the mass-production of inertial sensors.



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