Abstract

Due to small size, low cost, excellent technical features, and reliability, micro machined sensors are conquering step by step the market segments occupied by conventionally fabricated sensors. Inertial
sensors are no exception. These are of two types; accelerometers and gyroscopes.

In this project a few micromachined capacitive accelerometers are presented. An accelerometer is represented by a spring-mass-dashpot system. The displacement of the proof mass is proportional to acceleration applied.

The change in displacement is measured by positioning sensing mechanism.

Comb drives are used as the capacitive position sensing elements; here the sensor is built up as an interdigited differential capacitor, sensing the position change due to the acceleration applied.

A high frequency detection circuit drives the sensor in an open loop configuration.An accelerometer with an open loop range of +30g is designed for both UV-LIGA and surface micromachining technologies.
A large volume field of application of silicon +30g acceleration sensors is in their use of central air bag deployment system in automobiles.

The parameter effecting the sensitivity and bandwidth of the sensor are mass, spring constant and the damping.

The mass and damping depend on the dimensions of the sensor structure and the fluid damping used respectively.

While the spring constant has two components (a) Mechanical spring constant (dimensions of the structure) and (b) Electrical spring constant (spring softening, due to the electrostatic force caused by the driving voltage used for capacitance measurement). A design of the accelerometer using (i) surface micromachining and (ii) UV LIGA has been done. The high frequency detection circuit designed is a charge amplifier circuit. An operational amplifier is used for the capacitance to voltage conversion. The design of a low noise op-amp is discussed. An alternative circuit configuration using three op-amps and an envelope detector is discussed.