Dual-axis MEMS Accelerometer with T-shape Beams

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Abstract: Inertial navigation requires acceleration measurement along all three degree-of-freedoms. Most accelerometers are designed to measure acceleration along a single sensitive direction. For complete inertial sensing, a move effective accelerometer which can sense acceleration along multiple axes is needed. In this research, a dual-axis MEMS (Microelectromechanical Systems) accelerometer with T-shape beams is proposed. Due to its unique T-shape beam structure, the beams can bend along both X and Y directions along the device plane. A movable central mass is connected to both T-shape beams. In case there is acceleration input along X and Y directions, the inertial force experienced by movable mass cause the T-shape beams to bend. Four sets of movable fingers extrude along the sidewalls of the movable mass, with fixed fingers next to them to form two set of differential capacitances. The displacement of the movable mass along X and Y directions due to inertial force can be measured by sensing the differential capacitance changes, hence the input acceleration along X and Y directions can be known. ANSYS simulation is used to verify the vibrational modes and the displacement sensitivity of the accelerometer. Simulation results prove that the design accelerometer with T-shape beams can effectively measure accelerations along both X and Y directions. It can be used for inertial navigation system, gesture control and other applications.

Keywords: Microelectromechanical Systems (MEMS), Accelerometer, Dual-axis, Differential Capacitive Sensing, ANSYS Simulation.

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