Development of a gyroscope in a three-layer, CMOS compatible micromechanical process

Dipl.-Ing. Philipp Sasse

The design and development of a micromechanical gyroscope based on a CMOS compatible etching process is presented. There is a high demand on sensors of this type in automative applications like active stability control.

A concept is developed with an electrostatically excited sensor element. It performs a rotational oscillation parallel to the chip plane. Under the influence of an external rotation which is to be measured a second oszillation perpendicular to the chip plane is induced by the Coriolis force. It can be measured capacitively.

The novel three-layer design of the micromechanics allows for a symmetrical design with electrodes under and above the sensing element. The symmetry reduces several mechanical noise influences, and the closed top layer avoids the need for an expensive vacuum sealing of the mechanical structure.

Restrictions of this new process, like a high mechanical damping, require new strategies in the mechanical, control and circuitry design to meet the sensitivity goal. This thesis covers the concept of the sensor system, the design and optimization of the micromechanics, the development of the analog and digital circuits, simulation, measurement and a conclusion in the context of other development projects.