

Frequency-Output Gyroscope

A vibrating micro-machined gyroscope that enables direct angular-velocity measurement in frequency domains

Researchers at the Georgia Institute of Technology have developed a vibrating micro-machined gyroscope that enables direct angular-velocity measurement in frequency domain. In contrast to the common amplitude-output gyroscopes, an applied rotation rate generates a Coriolis force, which acts as an additional spring force on the sense resonator, thus resulting in a measurable shift of the resonance frequency of the sense mode. Both drive mode and sense mode are operated in closed-loop configuration with appropriate controllers adjusting the drive mode frequency to that of the sense mode while maintaining a 90° phase shift between them.

Summary Bullets

- Low-cost
- Constant resonant frequency of the drive mode
- Better sensitivity – minimal detectable frequency is only limited by short-term stability and counting period length

Solution Advantages

- Low-cost
- Constant resonant frequency of the drive mode
- Better sensitivity – minimal detectable frequency is only limited by short-term stability and counting period length
- Frequency domain operation eliminates complex converters
- Dynamic range can readily be adjusted
- Intrinsic offset cancellations/drift removal is included

Potential Commercial Applications

- Silicon-based sensors
- Companion with micro-machined accelerometers to provide heading information
- Internal navigation – ride stabilization, rollover detection, video-camera stabilization, virtual reality
- Military use – impact and void detection, safing missiles, and arming missiles

Background and More Information

Vibrating gyroscopes are instruments for measuring the angular velocity of a system with respect to an inertial reference frame. While conventional (rotating-wheel, precision fiber-optic and ring-laser gyroscopes) are too expensive/large for use in most applications, MEMS technology can shrink the gyroscope size by orders of magnitude, reducing the fabrication cost, and allowing the electronics to be integrated into the same silicon chip.

Inventors

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Publications

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Images

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