# PRECISION GYROSCOPE MODE-MATCHING INSENSITIVE TO RATE INPUT

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## PATENT STATUS

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## BRIEF DESCRIPTION

There is a wide range of applications for gyroscopes, including: inertial navigation, stabilization, maintaining direction. Many of these applications require low noise. One approach to reducing noise is to increase the mass of the gyroscope transducer. However, this generally comes with increased size and cost. Mode-matched gyroscopes avoid these penalties. These gyroscopes are based on transducers with high quality factor Q. Provided that the resonance frequencies of the drive and sense axes are equal, the noise is suppressed by the quality factor Q. The Q-factor of typical gyroscopes ranges from 1000 to several million, offering dramatic noise reduction. The required precision of mode-matching, which is on the order of 1/Q, presents an implementation challenge. For example, in a mode-matched gyroscope with Q=106, the relative deviation of the frequencies of oscillation of the drive and sense mode must be 10 6. This level of precision is not attainable by typical transducer fabrication techniques such as MEMS or trimming.

This innovation presents an alternative approach for continuously monitoring the split between the resonances of the drive and sense modes. While also based on a periodic calibration signal, it does not suffer from corruption of or from the rate measurement. Consequently, the frequency of the calibration signal can be chosen independently of the bandwidth of the rate input and instead set by the required tracking bandwidth of the mode split estimate. The latter is typically dominated by environmental variations such as temperature and on the order of 1Hz or less in typical implementations.

## SUGGESTED USES

Any applications that use gyroscopes.

## ADVANTAGES

The current system does not suffer from corruption of or from the rate measurement. Consequently, the frequency of the calibration signal can be chosen independently of the 25 bandwidth of the rate input and instead set by the required tracking bandwidth of the mode split estimate.

## RELATED MATERIALS

## CONTACT

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## INVENTORS

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## OTHER INFORMATION

**CATEGORIZED AS**

» **Sensors & Instrumentation**

» Position sensors

**RELATED CASES**

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