Method of simultaneously and directly generating an angular position and angular velocity measurement in a micromachined gyroscope

Tech ID: 27169 / UC Case 2004-104-0

BRIEF DESCRIPTION

The invention is in the field of MEMS gyroscopes capable of simultaneous measurement of angular position and angular rate.

A sensor is fabricated with micron feature sizes capable of simultaneously measuring absolute angles of rotation and angular rotational rates. The measurements are made directly from the position and velocity of the device without the need for electronic integration or differentiation. The device measures angle directly, avoiding the integration of electronic errors and allowing for higher performance in attitude measurement. These performance improvements and flexibility in usage allow for long term attitude sensing applications such as implantable prosthetics, micro-vehicle navigation, structural health monitoring, and long range smart munitions. Through the fabrication of the device using lithographic methods, the device can be made small and in large qualities, resulting in low costs and low power consumption.

FULL DESCRIPTION

All micromachined gyroscopes are vibratory in nature, measuring either angular rates by detecting energy coupled between orthogonal vibration modes due to Coriolis force or angle of rotation through the precession of an oscillation pattern. In a rate gyroscope, a structural element is forced into oscillation in one principle structural mode, designated the “drive” mode. The presence of rotation induced Coriolis force couples the sustained oscillation into an orthogonal structural mode, designated the “sense” mode. The magnitude of vibration induced in the sense mode is proportional to the rotation rate of the device.

However, these devices require integration of the electronic output signal to obtain orientation, magnifying drift and noise errors causing reduced performance. Prior work in the state of the art has produced a micromachined angle measuring gyroscope. However, the prior art control electronics of the gyroscope does not allow for the simultaneous detection of angular position and angular velocity. At present, no micromachined angle measuring devices exist on the market since designers are focused exclusively on the design of micromachined rate measuring gyroscopes. These devices require integration of the electronic output signal to obtain position, magnifying drift and noise errors which results in reduced performance.

In the illustrated embodiment a sensor is fabricated with micron feature sizes capable of simultaneously measuring absolute angles of rotation and angular rotational rates. The measurements are made directly from the position and velocity of the device without the need for electronic integration or differentiation.

The gyroscope of the invention measures angle directly, avoiding the integration of electronic errors and allowing for higher performance in attitude measurement. The capability to simultaneously measure angular rate allows flexibility for the end user who can use the device for rate and angle measurement without additional electronics. These performance improvements and flexibility in usage would allow for long term attitude sensing applications such as implantable prosthetics, micro-vehicle navigation, structural health monitoring, and long range smart munitions. Through the fabrication of the device using lithographic methods, the device can be made small and in large qualities, resulting in low costs and low power consumption.

The invention is an improvement in a method for controlling a micromachined gyroscope which is comprised of a substrate, a proof mass coupled to the substrate by an isotropic suspension such that the proof mass can move in any direction in a working plane, one or more drive electrodes configured to cause the proof

CONTACT

Edward Hsieh
hsiehe5@uci.edu
tel: 949-824-8428.

OTHER INFORMATION

CATEGORIZED AS

» **Sensors & Instrumentation**
» Other
» Physical Measurement
» Position sensors

RELATED CASES

2004-104-0

mass to oscillate in the working plane in a precessing elliptical path, and one or more sense electrodes configured to sense the motion of the proof mass in the working plane. The improvement comprises the steps of measuring the angle of precession of the elliptical path in the working plane from which an angle of rotation of the gyroscope is determined or is inversely equivalent and simultaneously measuring the angular rate of rotation of the gyroscope.

The steps of measuring the angle of precession or angle of rotation of the gyroscope and simultaneously measuring the angular rate of rotation of the gyroscope comprise measuring the position and the velocity of the proof mass in the working plane and generating the angle of precession and the angular rate of rotation of the gyroscope therefrom.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	7,040,164	05/09/2006	2004-104

UCI Beall
Applied Innovation

5270 California Avenue / Irvine,CA
92697-7700 / Tel: 949.824.2683