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Optical Radiation-Transduced Centripetal Accelerometer

A new micro-electro-mechanical system gyroscope design provides precise, rotation-rate information for navigation and guidance in extreme, high-acceleration environments, resisting shocks, vibrations, and temperature changes.

The use of micro-electro-mechanical systems (MEMS) gyroscopes for inertial navigation is an option when a GPS signal is not feasible. Current MEMS designs require many electrodes in order to function. These electrodes are a significant liability in high acceleration situations and temperature changes, such as projectile launches, because even a small change in the gaps affects stability. Currently, chip-scale gyroscopes that simultaneously provide operation through harsh environments while allowing navigation and sensor operation through that environment do not exist.

Researchers at Purdue University have developed a new type of MEMS gyroscope that radially expands when subjected to an input rotation around the anchor, making possible the precise measurement of the circumference change and the centripetal acceleration due to the rotation rate. The system's geometry is immune to disturbances from shocks, vibrations, perturbations, and temperature fluctuations. This technology is especially useful for ordnance guidance where it can continue to provide precise rotation rate information in a GPS-denied or GPS-contested environment.

Advantages:

-Not sensitive to temperature fluctuations

-Functions in extreme environments

-Resistant to linear shocks and vibrations

Potential Applications:

-Navigation

-Missiles

Technology ID

2016-BHAV-67240

Category

Aerospace & Defense/Defense Electronics & Surveillance Technologies

Semiconductors/Devices & Components

Robotics & Automation/Perception & Sensing

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-Projectiles

-Drone navigation

TRL: 2

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