Gyro Sensor Solution Displays Detection Accuracy in Minutes

Photo 1: North Finder (demo machine)

Photo 2: SCC2000 Series

The gyro sensor of Murata Manufacturing Co., Ltd. is used as a high-precision and high-performance product in the industrial, healthcare and automobile markets. In the automobile market, it is important to accurately measure the location information of the vehicle as automatic driving becomes more and more popular as a future transportation mode.

In view of this trend, the company has developed a machine that demonstrates the accuracy of the gyro sensor. The solutions that have enabled accurate detection of the due north and the development of the technology of detecting the location information are introduced in the article.

Finding True North

Murata's new North Finder can find true north in 2min. The fast and relatively inexpensive solution will enhance autonomous cars, but will also make it possible to navigate and position accurately in completely new applications.

For the very first time, Murata has developed a micro electro mechanical systems (MEMS) gyro sensor that can be used to determine true north in real-life applications.

Murata's gyro sensors are now in their third generation, and their development continues constantly to achieve ever better performance. The advances made in this work so far have been turned into a demo product called North Finder that can be used in finding true north in just 2min, with an accuracy of 2°.

Table 1: Specifications of Murata Manufacturing's gyro sensors

Item number	SCC2130-D08	SCC2230-D08	SCC2230-E02
Size	15.0×8.5×4.35mm		
Gyro detection axis	X	Z	Z
Gyro detection range	±125°/s	±125°/s	±125°/s
Acceleration detection range	±6g	±6g	±2g

New Applications Economically Feasible

Having an accurate, fast, and relatively inexpensive solution to finding true north will open up completely new possibilities in autonomous vehicles and positioning applications.

Autonomous cars are an obvious area of application, as they will need to know at all times where they are and where they are heading. This will be even more important in the future, when autonomous cars become more common.

"For example, when a car is parked in an area that is not on a map, it will need to know which way its nose is pointing. Otherwise it cannot find its way to the nearest road," says Tommi Vilenius, Senior Manager, Business Development, from Murata Electronics.

Using North Finder, autonomous cars can even drive short distances without a camera.

"I'm sure self-driving will extend to other vehicles, too, so true north information may one day be just as important to autonomous helicopters or other aircraft," Vilenius predicts.

North Finder could also be used in underground applications, such as mining or tunneling equipment. It would also be useful above ground with heavy-duty machines, like backhoes, bulldozers, or concrete pump trucks, which need precise location information to place their booms and nozzles in the correct position.

"We can envision many uses for the new component, but I'm sure others will come up with many others beyond our imagination," says Vilenius.

Finding True North with Gyro Sensors

Up till now, the problem in finding true north with MEMS gyro sensors has been noise. Now, Murata has managed to decrease it to an extremely low level. This combined with the accuracy with the sensors has made this possible to create the new solution.

However, the idea of building a gyrocompass using gyro sensors is not a new one; a team at the Tampere University of Technology created the very first experiment in 2010, using a prototype version of Murata's SCC1300 MEMS sensor.

The very first version of the gyrocompass found true north in 2 hours, with an improved algorithm in 15min. Even so, its use in practical applications was not feasible.

The high-performance gyro sensor measures the Earth's rotation. The Earth turns 360° in 24 hours, which equals 0.25° in a minute. North Finder points sequentially in north, east, south, and west. When the sensor is pointing to the north, the measured rate is the highest and pointing to the south, the lowest.

Magnetic North Pole Wanders

Knowing where north is essential in both navigation and positioning. Broadly speaking, the solutions used to find the north so far have been inaccurate or expensive.

The magnetic compass will give a faulty reading, when used in an environment with a high concentration of metals, like a ship or in an area where there is an abundance of magnetic ore, or just when they are indoors.

"Even when there are no error sources nearby, a magnetic compass has one major problem: it only indicates where the magnetic north pole lies, and when accuracy is needed, this is not enough," Vilenius points out.

The true north is always at the point where the Earth's axis of rotation meets its surface. The magnetic north, however, moves over time with magnetic changes in the Earth's core. At the moment, the magnetic north is in Canada, about 500km from true north.

Ring laser gyroscopes used in aircraft are accurate, but expensive. Satellite-based systems need visual contact to operate, so they cannot be used underground.

Murata's MEMS Technology

Murata's silicon capacitive sensors are made of single crystal silicon and glass. These materials ensure exceptional reliability, unprecedented accuracy and excellent stability over time and temperature. Manufacturing technologies are borrowed from semiconductor industry, which provides mass production capability and cost efficiency.

Murata's MEMS sensors are robust structures, whose symmetry and sound design principles help improve stability, linearity, cross-axis sensitivity and susceptibility to vibrations. The company's 3D MEMS are hermetically sealed, so no particles or chemicals can enter them, ensuring reliability.

Note:

This article shows the accuracy of Murata Manufacturing's gyro sensor. Demo devices and/or algorithm are neither distributed nor sold.

About This Article:

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