

OSCILLATING TEST RIG FOR MEMS GYROSCOPES

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Background

Motion sensors like MEMS accelerometers and gyroscopes (gyros) are rather small, cheap and reliable sensors that have found their place in a variety of applications. Some of the applications are in the field of human motion measurements. This is a growing market field and an increasing number of MEMS sensors find their way into products for human measurements, such as fall detection, running sensor, movement capacity analysis and stress measurement. In many of these applications the sensors are supposed to be worn by a human for a longer time to track their movements in one way or another. For MEMS gyros in particular, it is interesting to study the sensors reactions to typical human movements over time. Comparing humans and machines, human movements are often smoother and more oscillating than the more linear movement pattern of a machine. Datasheets for gyros usually only specify hard performance like resistance to impact and shock. It is also quite common that the datasheets are incorrect, especially for brand new sensors being released in new versions.

Information/result

To help engineers choose gyro sensor and also verify the gyro sensor parameters and function an oscillating test rig was developed. The test rig is based on experience and results from two other test rigs, one for MEMS gyros and one for MEMS accelerometers. In these test rigs a start and stop procedure affects the motion measurements. This occurs when changing the direction of motion as the engine has to be stopped and reversed. To get a smooth change of the direction it was necessary to slow down the rotating disc (gyro) or the sleigh (accelerometer) before stop and then ramp up the speed again. To get an even smoother transition when changing the direction of rotation a solution with two discs connected by a rod was chosen. The engine can drive one of the discs with various speeds and thanks to the rod connection the other disc will perform a smooth oscillating movement.

Industrial possibilities

The test rig has been used to evaluate different gyros. Intended applications for these gyros are in contexts where the sensors are carried by a person. The test rig has mainly been used to investigate the gyro signal behavior at the turning movement in the stop/start process. The collected data has been used to evaluate different signal processing algorithms for detection and further analysis of human motion patterns and also to reduce drift and noise in the sensor signal. The test rig has been a good help in the evaluation process for new human-worn products.

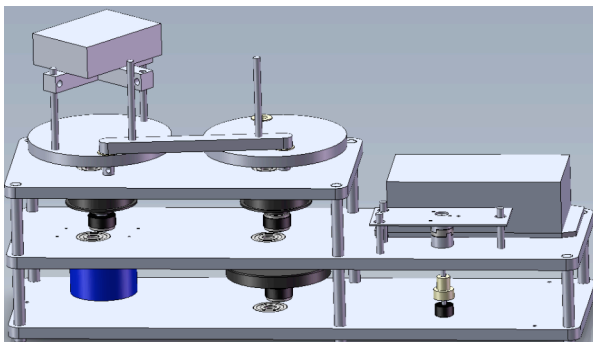


Figure 1. The oscillating test rig.

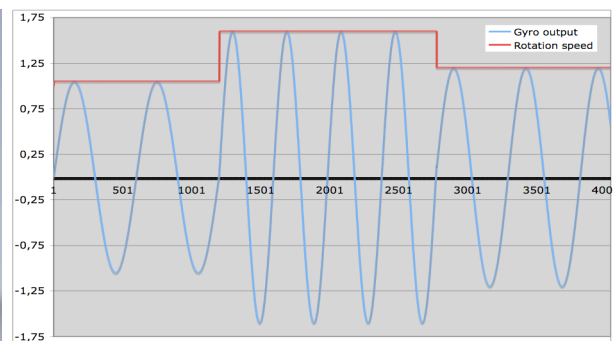


Figure 2. Gyro output at different rotation speeds.