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A LOW COST HIGH PERFORMANCE GYRO FOR SMALL/MICRO SATELLITES IN LEO

Abstract

Innalabs Ltd is an Irish company which develops and manufactures in serial production high-grade Coriolis Vibratory Gyroscopes (CVG) for land, marine, and aerospace applications. Innalabs proprietary Coriolis Vibratory Gyroscope is an innovative new technology which can be defined as a low cost medium range HRG (Hemispherical Resonator Gyro), the sensor of choice for high value satellites for the last 20 years.

The characteristics of the technology developed by Innalabs, in particular very high MTBF (>500,000 Hr), low output noise and ARW, together with very good stability of both bias and scale factor, are ideally suited for angular rate measurement on board of satellites. The physical characteristics of the gyro (<200g per axis, with a power consumption <2 W per axis, robustness to shocks and vibrations) allow the use of Innalabs standard gyros in small and micro satellites and guarantee very high performance even after launch environmental conditions. The gyro can be customized by changing bandwidth, measurement range, and other configuration features according to customer request. By configuring the gyro with a 25 deg/s measurement range and a bandwidth of 25 Hz (both of them exceeding real operating conditions of satellites), the ARW is lower than 0.003 $deg/\sqrt{hr}$, the in-run bias stability is lower than 0.03 deg/hr, and the noise up to 100 Hz is lower than 7 deg/hr. The gyro is provided with either an analogue output or a digital one with RS422 interface. As a difference from gyros used in land/marine/aeronautics applications, Innalabs is able to manufacture gyros by adapting processes and material to the space environment (e.g. leaded solders) without impacting the gyro performance. This gyro is able to meet or exceed requirements for attitude measurement for LEO missions and constellations currently under design for Earth observation, telecommunications, internet broadcasting.

Gyro configuration and physical properties are described in detail, with particular attention to compatibility with the space environment. Statistical data on key performance characteristics are presented including Allan Variance, bias stability, scale factor stability, and output noise. Test results of a gyro developed for a LEO satellite, due to launch in 2015, are presented in the paper as a case study of Innalabs' capabilities in the space sector.