

Noise Characteristics of Ring-core sensor for Fluxgate Magnetometer

Motoki Baba[1], Ryuta Tanaka[2], yasuko torii[2], Fumio Tohyama[3]

[1] Aeronautics and Astronautics.Tokai Univ, [2] Space Engineer.,Tokai Univ, [3] Space Engineer., Tokai Univ

High sensitive fluxgate magnetometer is mostly used in detecting space magnetic field on satellites and at ground observatories, and the resolution is high like 0.01 nT and the range is wide to 100,000 nT. Recently, many planet missions for detecting magnetic field are proposed like surveying on the Moon, Mars and Mercury, so high resolution and low noise sensor of fluxgate magnetometer are required. But there is not a noise model of sensor core. We have examined and tested many ring sensor cores to understand what parameters (drive frequency, drive amplitude, wraps and size of ring core) reduce the output noise and what conditions improve the sensitivity. As results, the noise level of 27mm-1 5T core was 7.2pTrms.

High sensitive fluxgate magnetometer is mostly used in detecting space magnetic field on satellites and at ground observatories, and the resolution is high like 0.01 nT and the range is wide to 100,000 nT. Recently, many planet missions for detecting magnetic field are proposed like surveying on the Moon, Mars and Mercury, so high resolution and low noise sensor of fluxgate magnetometer are required. But there is not a noise model of sensor core. We have examined and tested many ring sensor cores of fluxgate magnetometer which is used in Japan(81Ni-4Mo Permalloy) and US. What is the best of drive frequency and amplitude, wraps, size of ring core, and what changes are shown in characteristics of output associated with temperature changes and magnetization of core material?

We have tested many sample cores that are different on radius, wraps, material of core.

As results, we have got some conditions for low noise sensor core as the below .

- (1) Drive amplitude to drive coil is required above 10 Oe (p-p)
- (2) The best drive frequency for low noise and high sensitivity is about 8 kHz.
- (3) Reasonable number of winding core is about 10 wraps at 18mm and 15 wraps at 27mm.
- (4) The noise level of our best core was 7.2pTrms.
- (5) Sensitivity is proportional to the cubic of ring core radius and also depended on maximum differential permeability of the permalloy core.
- (6) The Japanese core is superior to the US core in room temperature but noise level of the US core is smaller than that of the Japanese core in the temperature changes. This is due to the bobbin material.