

## Development of the ASIC for fluxgate magnetometers onboard space exploration satellites

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Fluxgate magnetometers have many advantages, good accuracy, small-size, lightweight, and low-power consumption. Therefore they have been most often used for space science missions to measure the earth, planetary and interplanetary magnetic fields. Recently it is required to further reduce the resources of the scientific instruments for space missions keeping the high performance levels of conventional instruments.

To realize a miniaturized and low-power fluxgate magnetometer, an analog Application Specific Integrated Circuit(ASIC 0.5 micrometer process) for the signal processing has been developed. Our newly designed magnetometer consists of the analog ASIC part and the digital processing part. The digital processing part was already developed and realized by sounding rocket experiments(S-310-38 and S-310-40).

In our presentation, we focus on the results of the ASIC design. The ASIC contains two channels and the single channel contains an amplifier and a band-pass filter. The gain of the amplifier is variable (2, 3, ... ,10 times) by the external signals given to the ASIC. The band-pass filter is the second-order Butterworth filter and the center frequency is adjusted to 22 kHz, the frequency of the pickup signal of the fluxgate magnetometer. The dimension of the ASIC is 5 mm by 5 mm. The performance and the temperature dependence of the designed circuit were evaluated by the circuit simulator. The power consumption is about 5 mW(5.0 V, 1 mA). The output dynamic range is 0.24 F.S.(corresponding to 1.2 V). The frequency characteristic of the band-pass filter satisfies the requirement. The noise density in the output signal is less than 600 nV/Hz<sup>1/2</sup> @ 1 Hz(corresponding to 2 pT/Hz<sup>1/2</sup>) in the temperature range between -30 degrees C and 50 degrees C. The simulation results indicated that the overall performance of the designed ASIC satisfies the requirements.

Keywords: fluxgate magnetometer, ASIC, digital-type, amplifier, band-pass filter