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Zoom meeting B ：11/4 AM1 (9:00-10:30)
10:15〜10:30

Design of the analog chip utilized in Fundamental Mode Orthogonal Fluxgate Magnetometers

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We are working to design an analog circuit chip dedicated to Fundamental Mode Orthogonal Fluxgate Magnetometers, which will be installed on future scientific satellites. Fluxgate magnetometers are commonly used for measuring DC magnetic fields as well as low frequency magnetic field fluctuations in space missions. Conventional “parallel” fluxgate magnetometers have employed a ring-core sensor, because the sensor shows good noise characteristics and stability of output offset voltages. Parallel fluxgate magnetometers with ring-core sensors have been contributing to a lot of space missions. On the other hand, the sensor is complex in structure, and it requires a sufficiently large core to achieve low-noise detection of magnetic fields. The ring core sensor is hence unsuitable for miniaturization of the instrument. However, progress of micro-/nano-satellites emphasizes a need for miniaturization of onboard instruments. Recently, a new type of fluxgate magnetometers called “Fundamental Mode Orthogonal Fluxgate (FM-OFG)” magnetometer has been introduced. The sensor of the FM-OFG magnetometer consists of a pair of amorphous wire core and a pick-up/feedback coil. There is no need of excitation coils that are necessary for the ring-core sensor. While it is difficult to get below 10 gram per axis with a ring-core sensor, the FM-OFG sensor can be made much lighter at about 1 gram per axis. The FM-OFG sensor causes breakthrough in the miniaturization of fluxgate magnetometers.

To pursue a small and light fluxgate magnetometer, miniaturizing electronic circuits is also crucial. The present paper focuses on miniaturizing the electronic circuits of the FM-OFG magnetometer by developing an analog chip, which is so-called the ASIC (Application Specific Integrated Circuit). We design essential analog components of the FM-OFG electronic circuits and make it a goal to implement them on a small chip with a size of a few tens of millimeter square. The FM-OFG electronic circuits have two main components. They are the part for exciting a wire core and the part for picking up signals from the sensor head and retrieving waveforms of detected magnetic fields based on a feedback configuration. As the first step, we start with designing the latter part of the circuit and evaluating performance of the chip based on circuit simulations.