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Digital, tuned, fluxgate magnetometers for the JGO mission

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Abstract

The magnetic field is a fundamental physical parameter, vital for the study of processes in interplanetary space. It is a key measurement in the study of the Jovian satellites and their interaction with Jupiter's giant magnetosphere. A magnetometer can provide information on induced and internal magnetic signatures at planetary bodies thereby constraining models of their internal structure. It can also resolve the planetary rotation rate, characterise local plasma transport etc. Its accurate measurement is crucial in future missions to the outer planets.

Being rugged, low in mass and power and offering high precision, the fluxgate sensor has emerged as an excellent magnetic field sensor for measuring fields from DC to a few tens of hertz on space missions. Here we describe a digital field extraction fluxgate magnetometer sensor system for the Jupiter Ganymede Orbiter. We propose some incremental technology developments that will optimise the sensor and its associated electronics (which has considerable space heritage) for the harsh radiation environment and tight resource constraints of the mission. Digital detection can have considerable size, weight and power advantages (key requirements for outer planet missions) over analogue equivalent fluxgate magnetometer designs[1]. The digital design also lends itself to implementation on either an FPGA or ASIC based platform, which leads to flexibility in choice of radiation hard components and in terms of connectivity to distributed spacecraft systems. We will look at options to reduce the mass of the sensor, whilst still maintaining high performance, and options for reducing the operating temperature – which has the benefit of reducing the required sensor heating power budget.

References

[1] O'Brien, H. et al (2007) *Meas. Sci. Technol. 18 3645–50*