

Absolute vector magnetometers for spaceborn and ground observatories

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Abstract :

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Scalar and vector magnetometers are traditionally combined on magnetic mapping satellites and in ground based observatories. While the vector instrument is basically operated as a variometer, the scalar one provides the absolute reference either to calibrate the vector magnetometer (satellites) or to correct its long term drifts (magnetic stations).

In this paper we present an innovative architecture thanks to which continuous vector measurements are derived from an intrinsically scalar instrument, hence delivering simultaneously both the magnitude and the direction of the ambient magnetic field. This design has been implemented on the Absolute Scalar Magnetometer which will be the magnetic reference for the three ESA Swarm satellites expected to be launched in 2012.

The main design constraints are highlighted and results of its calibration process and performances in terms of precision and accuracy are analyzed. While the main advantage of this instrument lies in the lack of offsets or drifts, its precision in vector mode is by design significantly lower than the scalar one. This could however be significantly improved for instruments dedicated to geomagnetic observatories in which the magnetometer attitude is constant, thus offering new possibilities for optimization that could not be investigated in case of mobile applications.

This is being demonstrated on a prototype whose development is in progress; preliminary characterization results will be presented and discussed. This new concept could be of great interest for magnetic observatories as it avoids frequent and regular on-site maintenance and thus paves the way for opening new sites of difficult access.