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Peculiarities of Magnetic Field Component Measurement from Moving Carriers

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At the magnetic field study from moving carriers in exploration geophysics, archeology, soil mapping and UXO detection the scalar magnetometers dominate. It is known that obtaining of 3-component magnetic field data instead of module gives higher processing precision, so the fluxgate magnetometers (FGM) seem to be the more preferable, also by reason of lower weight, noise, and power consumption.
The operation of FGMs onboard moving carriers faces a number of difficulties that limit their application in geophysics. This is due to the fact that the measurements of weak magnetic anomalies are made in the presence of strong Earth's magnetic field B. The moving FGM has essential space rotation and thus creates great signal change. As an example, for a sensor being at given moment orthogonal to the vector B, the rotation at an angle of one thousandth of degree only can lead to the appearance of an additional signal up to 1.2 nT. So it is very important to know with high precision the real FGM axes orientation for elimination of this error from the data.
Other obstacles limiting the FGM sensitivity threshold and related to the FGM rotation in the Earth's magnetic field are the FGM axes non-orthogonality and its sensors transformation factor non-uniformity. It appeared that, being not important for stable FGM positioning, at its rotation a strong interference signal is created due to these factors.
More detailed calculations showed that in order the interference signal value would be at the level of natural interference - say, do not exceeding 1 nT - the required sensor axes non-orthogonality should be decreased up to 10-3 of angular degree and the control of the magnetic channels transformation coefficient should be at the level 2*10-5, i. e. 0.002%. It is clear that such conditions can not be fulfilled at manufacturing stage.
A new method to determine the real FGM channels mutual orthogonality deflection and transformation factors non-identity with given precision for further use of these values at data processing was proposed and experimentally confirmed. The obtained results are discussed in the report.