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Three axial automatic compensation system for reducing slow fluctuation inside MSR

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Magnetically shielded rooms (MSRs) significantly attenuate the ambient magnetic field, making it possible to perform measurements of very low signals. For measurements with optically pumped magnetometers (OPMs), such rooms are, in most cases, essential. In a two-layer magnetically shielded room at the Faculty of Mechatronics, Warsaw University of Technology, the QuSpin Zero-Field Magnetometer (QZFM) sensors are in use.

These sensors are equipped with an internal compensation for the static ambient magnetic field, making them suitable for magnetic field measurements within the range down to ±5 nT. However, the urban environment affects the measurement conditions inside the MSR. The proximity of tram and subway lines, with drives powered by direct current, causes slow changes in magnetic induction that are present inside the MSR. Such environmental noise impacts the performance of OPM sensors, especially at the sensitivity of 8.1nT/V, as temporary sensor saturation and data loss may occur.

Here we present a three-axis magnetic field compensation system designed to reduce slow fluctuations of the magnetic field. The system allows for the suppression of low-frequency (below 1 Hz) magnetic field fluctuations within the working area of the compensation coils [1]. The control loop is based on fluxgate sensors, which lowers the overall cost of the system. The data from OPM sensors [2] is not required for the compensation system to operate.

References

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