Feedback and bandwidth in self-oscillating and radio-frequency OPMs

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The instantaneous response in atomic Larmor frequency to changes in magnetic field is a significant advantage of OPMs and can be exploited for high bandwidth field measurements using free-induction (FID) readout [1,2]. However, in OPM schemes which exploit resonant modulation to increase signal amplitude and duty cycle, the response to field changes depends non-trivially on feedback latency and atomic relaxation rate [3]. Additionally, in tuned radio-frequency OPMs [4], response to variation in signal phase and frequency has a strong dependence on atomic relaxation, implying a trade-off between the sensitivity and bandwidth of these devices.

We examine the implementation of low-latency digital feedback in modulated OPM systems, including data showing the resulting bandwidth, sensitivity limits and common-mode noise rejection. We discuss digital design optimization and applications for portable OPM systems exploiting these concepts.

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References

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