Optimal control of single spins in diamond for quantum sensing

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The electronic spin of Nitrogen-Vacancy (NV) centers in diamond has emerged as an ideal candidate for quantum sensing of both static and time-varying magnetic fields, guaranteeing high sensitivity and spatial resolution, operation in ambient conditions, and biocompatibility. In order to obtain a full development of this platform, optimized control of the NV spin is necessary.
Here [1], we exploit optimal control techniques based on numerical optimization in order to reach the optimal trade-off between decoupling from external noise and target filtering, demonstrating an improvement of the sensors sensitivity in a wide frequency domain. This new approach can enhance sensitivity in challenging quantum sensing tasks as the measurements of weak time-varying signals, e.g., the magnetic fields associated to neuronal cells, with arbitrary time dependence.

[1] F. Poggiali, et al., arXiv:1712.08256, 2017.