Manual of 2D Fourier Imaging simulation code

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1 Operations in Matlab

The main simulation is done in Matlab. The main code entails

1. parameter setting

2. prepare NV grid

3. prepare magnetic field

4. perform Fourier imaging using NV centers (Ramsey sequence)

5. perform inverse Fourier transformation

6. locate NV centers in the sample

7. pick up magnetic field points at the location of NV centers

8. If we consider scanning in the real space, there is an overall scanning module in the code to repeat the steps from 3-7 several times.

2   Operations in R studio

The reconstructed magnetic field profile is generated in Matlab and exported to excel in the form of $[x, y, val]$.

Since the reconstruction results are in general non-uniformly distributed, the traditional Fourier transformation cannot be directly applied. So then the dataset is imported from excel to R studio to transform the real space reconstruction results into Fourier space using the 2D Lomb-Scargle method[1].

The operations in R studio are listed as follows:

```r
># firstly install the package
>install.packages("spectral")
>library(spectral)

># display with lattice
>levelplot(val~x+y,X2d_LS)

># creating frequency space
>f <- expand.grid( fx = seq(0,1000,by = 10)
                  ,fy = seq(0,1000,by = 10)
)

># use the Lomb-Scargle method
># transform the real space data into Fourier space
> l <- spec.lomb(y = X2d_LS
           ,f = f
           ,mode = "generalized"
 )

># display the 2D pattern
> levelplot(PSD~fx+fy,l)
```

References

[1] Seilmayer, M., Gonzalez, F. G. Wondrak, T. The Multivariate Extension of the Lomb-Scargle Method. 35.