

# Magnetism in materials

solutions Week 09

The notebook SQUID.ipynb simulates a SQUID magnetometer measurement.

1. Start by turning off the option that adds perturbations to the signal and observe how it is formed as you move the sample through the coils with the slider.
2. Turn on the options to add perturbations to the signal, as the presence of impurities on the sample holder which can give a spurious signal. You can change the size of the perturbations by adjusting the variable that sets their amplitude.
3. fit the data according to the curve to the curve

$$F(Z) = X_1 + X_2 Z + X_3 \left\{ 2 [R^2 + (Z + X_4)]^{-3/2} - [R^2 + (\Lambda + Z + X_4)]^{-3/2} - [R^2 + (-\Lambda + Z + X_4)]^{-3/2} \right\}$$

where  $Z$  is the sample holder position,  $R$  is the coils radius,  $\Lambda$  the coils separation distance and  $X_i$  are fitting parameters. Add perturbations to the signal and vary their relative amplitude, to see how good are the fit results compared to the parameters setted for the signal. Think of how you can optimize the fitting procedure in case the signal is heavily perturbed for instance by the presence of a spurious signal larger than the sample one.