MRI Task 1 Report

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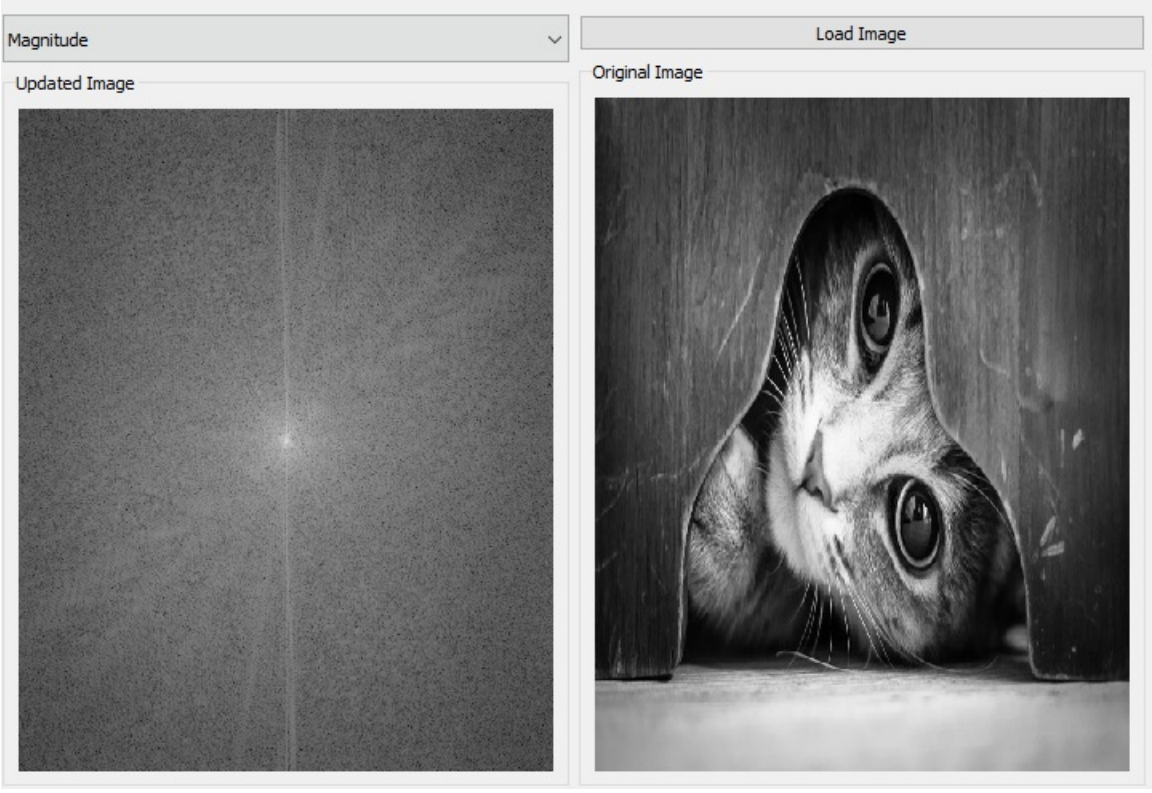
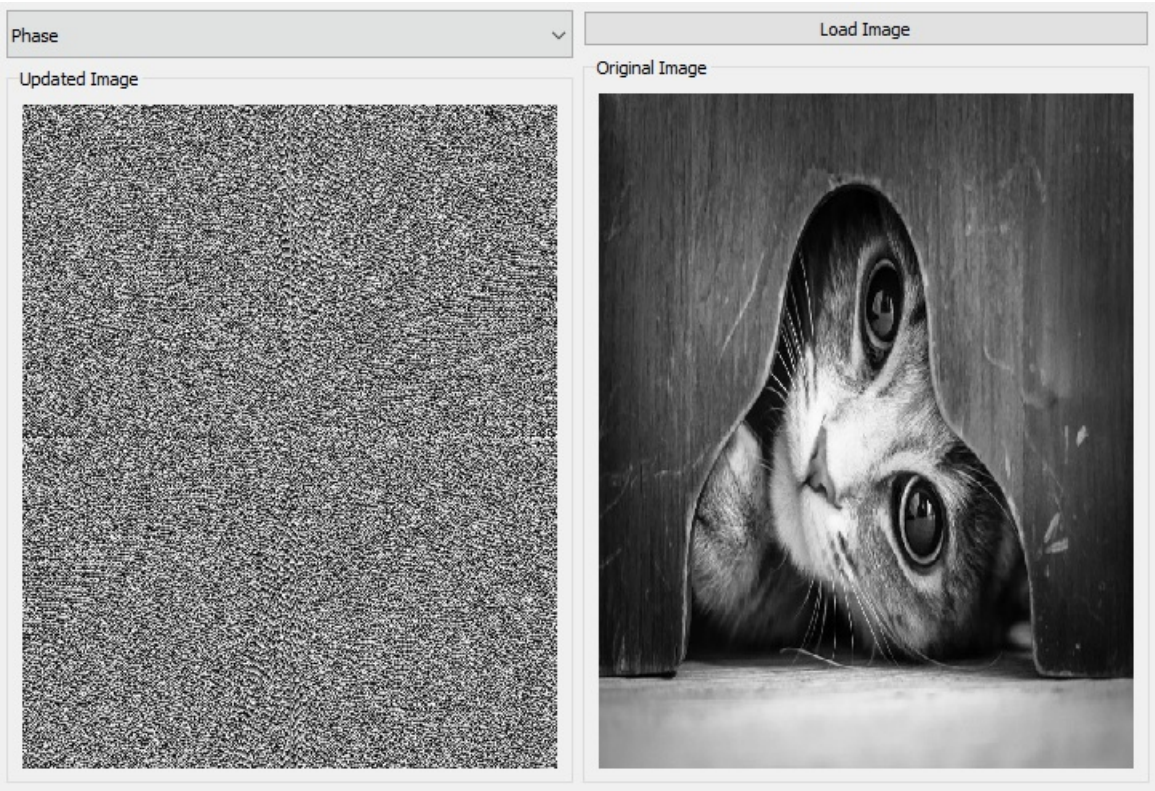
Fourier Transform

By applying the Discrete Fast Fourier Transform method, we obtained the Fourier Transform of an image, we then plotted its Components (Magnitude, Phase, Real Part, Imaginary Part) Separately.

Magnitude of an Image:

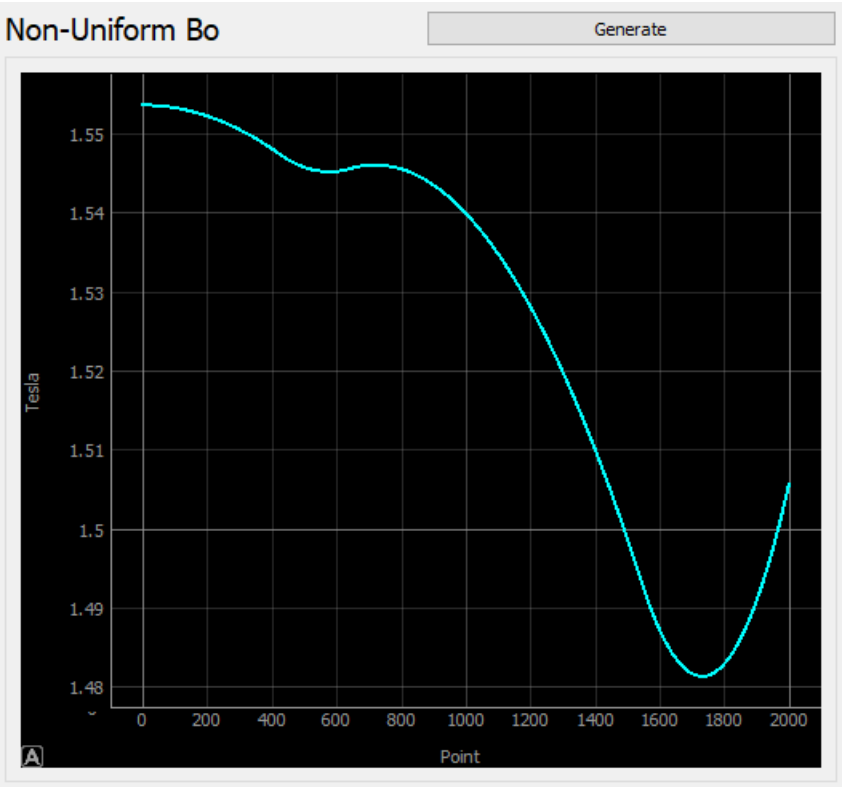


It's Phase



Non-Uniform Magnetic Field

We created a function that simulates the non-uniformity of a magnet, giving it the theoretical magnetic flux density in Tesla, maximum deviation due to the non-uniformity and the length of the magnet, using this data it generates a random curve we then plot this curve in our program.



Relaxation Process

It's a process where the spins, which received a Radio Frequency pulse which caused it to change the direction of its field, to release the energy it received from the pulse while returning to its original position

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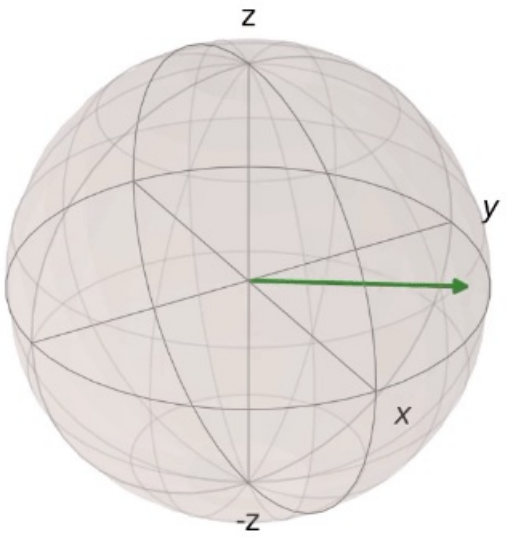
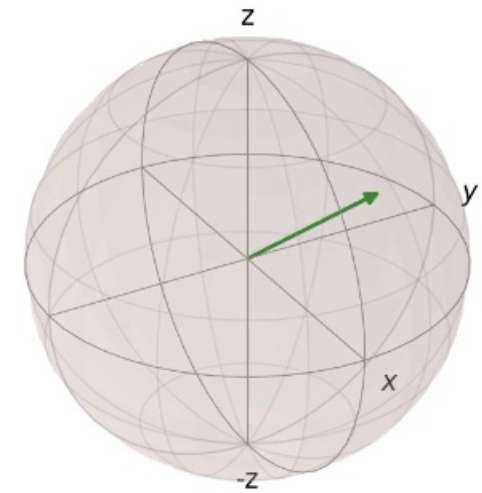
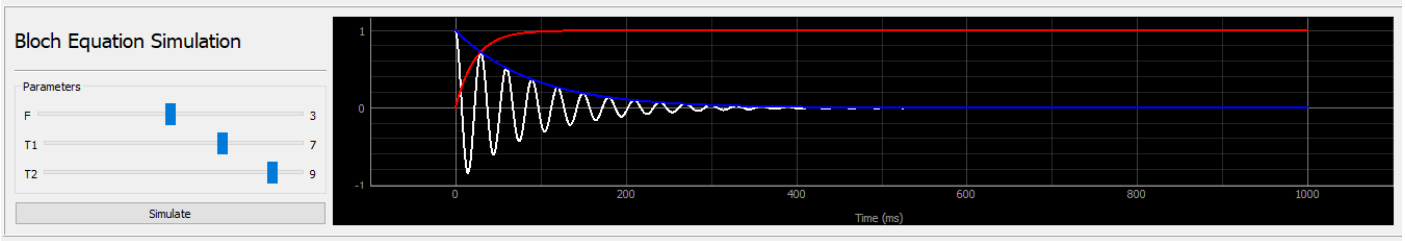
The following image demonstrates the Rotating Frame



The Precession



Bloch Equation Simulation



Transverse Relaxation.

Transverse relaxation is an exponential decay process of the x and y components of magnetization that is always happening. Pulse Echo Time `TE` is the waiting time after the `RF` pulse sequence before measuring the signal. Mathematically this means

$Mx(t)=Mx(0)exp(-TE/T2)$ (1)

and

$My(t)=My(0)exp(-TE/T2)$ (2)

the blue line in the plot shows how it happened.

Longitudinal Relaxation.

Longitudinal `z` relaxation is a bit more complicated than transverse relaxation. The magnetization recovers exponentially with a time constant T1, to a non-zero value, often called M0. Pulse Repetition Time `TR` is the time between 2 successive `RF` Pulse sequence .Mathematically, we write

$Mz(t)=M0*[1-exp(-TR/T1)]$ (3)

the red line in the plot shows how it happened.