

# Assignment No 3:Fitting data to models

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## 1 Introduction

This week's assignment starts off with generating data as a linear combination of the Bessel Function and some noise.  $f(t)=A*J_2(t)-B*t+n(t)$  where

- $A=1.05$
- $B=-0.105$
- $J_2(t)$ =Bessel function of 2nd order
- $n(t)$ = Noise function

## Assignment problems

### Part 2

loadtxt function was used to import data from the file. The data consists of 10 columns. The first column represents the time and the remaining 9 columns are the required function values with varying levels of noise.

```
data=np.loadtxt("fitting.dat")
x=data[:,0]
y=data[:,1:]
```

### Parts 3,4

The plot generated from the data given and the original function with  $A=1.05$  and  $B=-0.105$  are plotted using the plot function.

### Part 5

The errorbars are represented by red dots

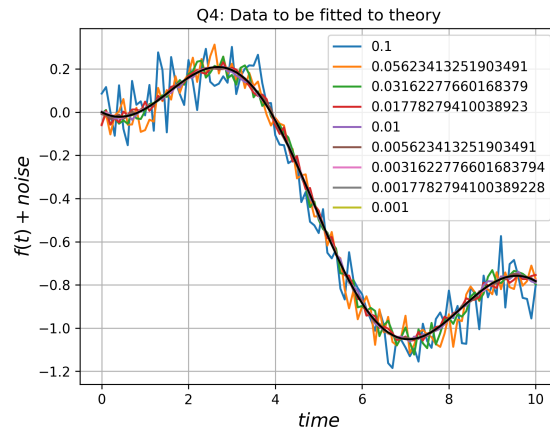


Figure 1: Combined plot for parts 3 and 4

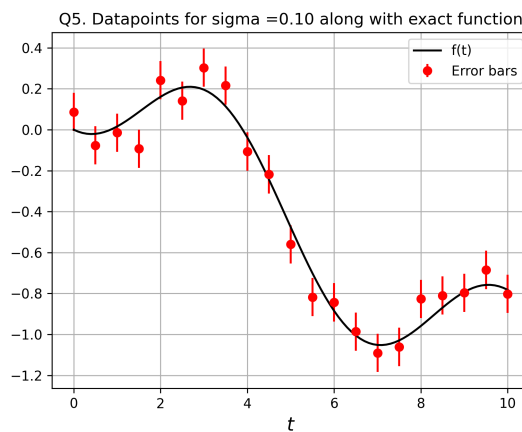


Figure 2: Plot for part 5

## Parts 6 and 7

We can use the if function and use flags to check whether the 2 arrays are equal or not. And we can find the error matrix by appending the values using a for loop.

## Part 8

```
CS=contour(A,B,E,levels=20) #Plotting the contour plot of the
plot(1.05,-0.105,marker='o',color='r',label='$Exact\_location$')
title('Contour\_Plot\_of\_Error\_Eij')
xlabel(r'$A$',size=10)
```

```

ylabel(r'$B$',size=10)
clabel(CS,CS.levels[:4], inline=1, fontsize=10)
grid()

```

The contour plot of the mean squared error versus the parameters A and B is given in the below plot. As we can see, there is a single minima at the indicated point in the plot.

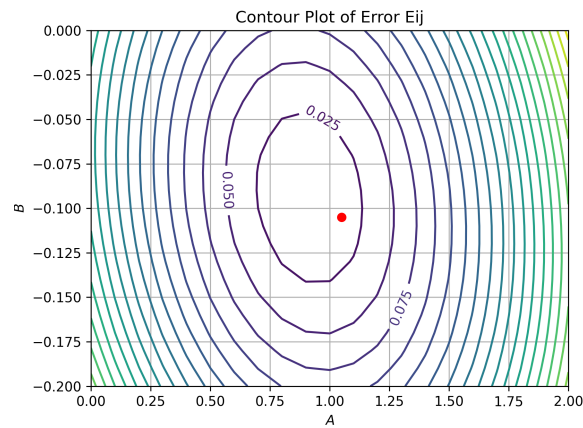


Figure 3: Plot for part 8

## Part 10

The plot of error in the estimate of A and B with noise is given in figure 4. As we can see, the error in estimate has non linear variation.

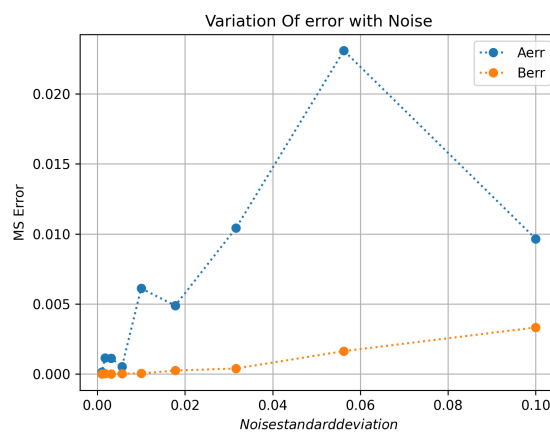


Figure 4: Plot for part 10

## Part 11

Here , we must use the `plot.loglog` function instead of just using `plot`. However when we plot the error returned by the `lstsq` function It is nearly linear. This is because our noise varies on a logarithmic scale.

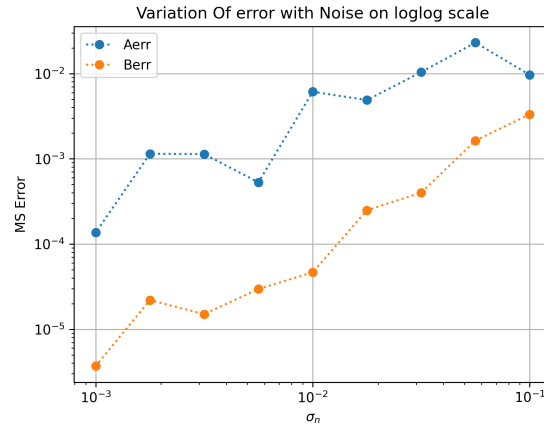


Figure 5: Plot for part 11