LAB 4

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1 Report

In this lab we are trying to fit data computed using fourier series and lstsq to original functions e^x and $cos(cosx)$.

first we plotted e^x in semilog and cos(cosx) in semilogy and linear scales.These are shown in fig1 and fig2.The fourier series of e^x diverges from e^x since it is not periodic.

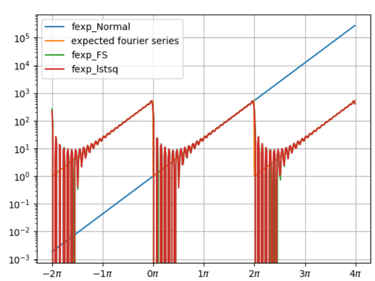

Figure 1: plot1

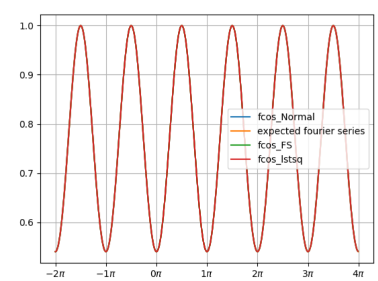

Figure 2: plot2

Then we tried to calculate fourier series coefficients of the functions and plotted them in both semilog and loglog axes.The plots for these are shown from fig3 to fig6.

Since cos(cosx) is an even function coefficients of sine are nearly zero as sin(x) is an odd function.

Also,coefficients decay faster for cos(cosx) because it is periodic.But for e^x, we need more frequencies to fit the function as it is not periodic.

Then we used least square method to find the fourier coefficients of the given functions by creating a matrix A containing sine and cos harmonics upto 25^{th} order and column vector containing original values of functions called b.// By solving Ac=b we can get c which contains the fourier coefficients.

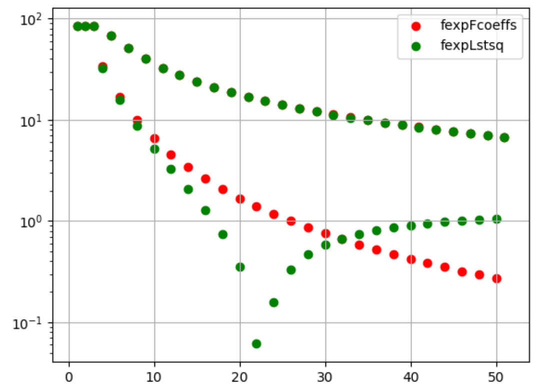

Figure 3: plot3

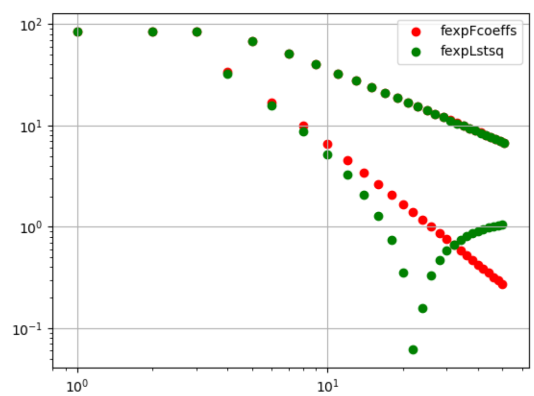

Figure 4: plot4

linearity of coefficients can be obtained by writing cos and sin in terms of e^{jw},e^{-jw}.
Then we plotted these values from lstsq method in the corresponding plots.And hence the above plots are obtained.

Then we got the maximum deviation between coefficients calculated in both

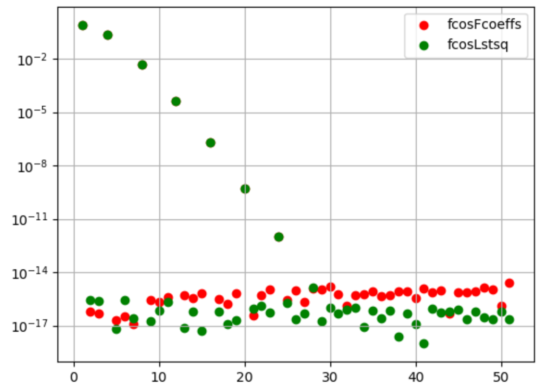

Figure 5: plot5

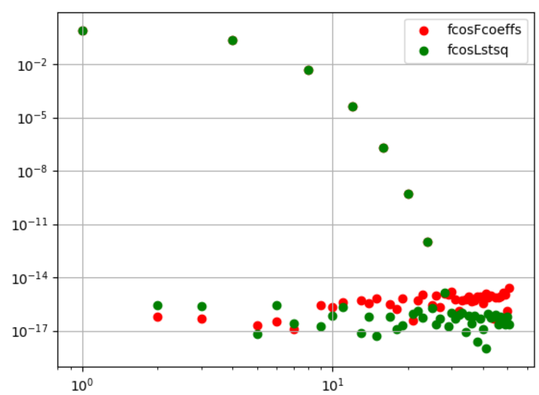

Figure 6: plot6

these methods as 1.3327308 for e^x and 2.5816134*10^{-15} for cos(cosx)

Lastly,we plotted the functions using the fourier series and (least square estimate).we find that both the functions fit perfectly for cos(cosx) but not for e^x because cos(cosx) is periodic and e^x is not periodic.The least square is more accurate compared to fourier series