Homework Work 3 - Physics 240

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1 Introduction

This is an exercise to test the approximation of e^x using the Taylor expansion in the form of:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + ... = \lim_{N \to \infty} S(x, N) \quad (1)$$

Where S(x,N) is the partial sum. The figure below shows the plots of the absolute fractional error $|S(x, N) - e^x|/e^x$ versus N. As we can see, this method is not good for approximating e^x when x $<$ 0 because there will be a discontinuation in the graph, using this model, the series will have alternating + and -, and that result in round of error.

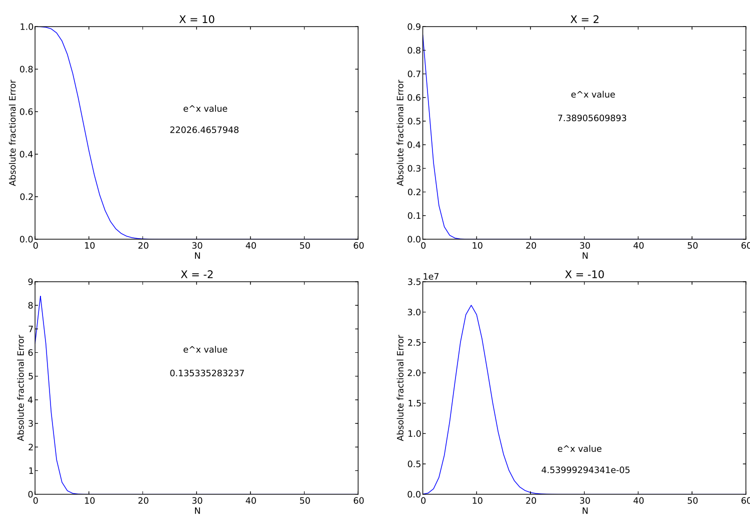

Figure 1: Approximation using the formula in (1) for e^x

2 Modified model

Using the new identity $e^x = 1/e^{-x} = 1/S(-x, N)$, there are less round of error because there is no negative, so there's nothing to substract. This results in a smoother curve for the fractional error versus N, as shown in the figure below

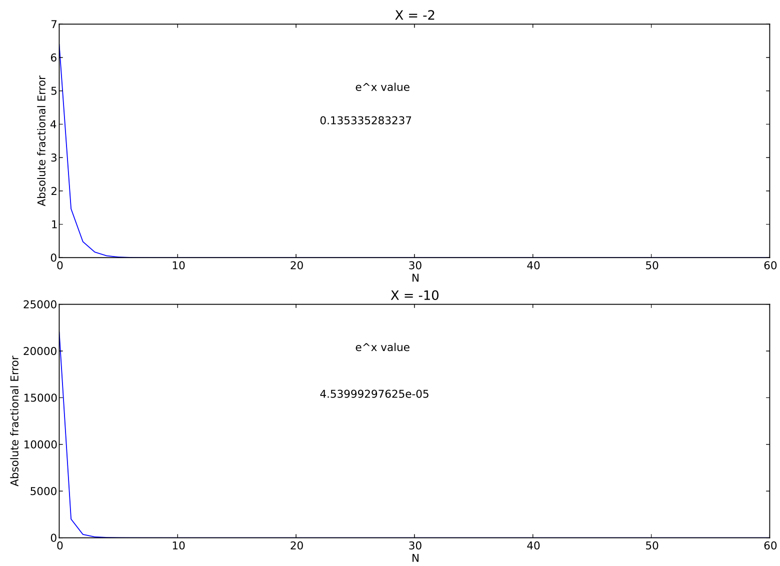

Figure 2: Approximation using the new identity for e^x