COMPUTING REPORT 2 MACM 316

Khang Vu
301255281

For this exploration into finite-precision error of Matlab's Gaussian Elimination backslash command for large tridiagonal matrices, I decided to choose the number of trials performed for each value of N to be 800. This is an arbitrary number that I think is large enough so as to lessen the standard deviation and small enough to be performed on my computer for large values of N.

For the values of N, I chose the numbers [10, 33, 66, 100, 333, 666, 1000, 3333, 6666, 10000]. The idea is to span a relative large range, up to a value that Matlab can still compute. The numbers are also chosen to show changes in different N values with a small difference (10,33,66) and changes in different N values with a bigger difference (1000,3333,6666,10000).

Figure 1 is the result of the calculations of the mean errors over 800 trials for tridiagonal matrices of these ten sizes.

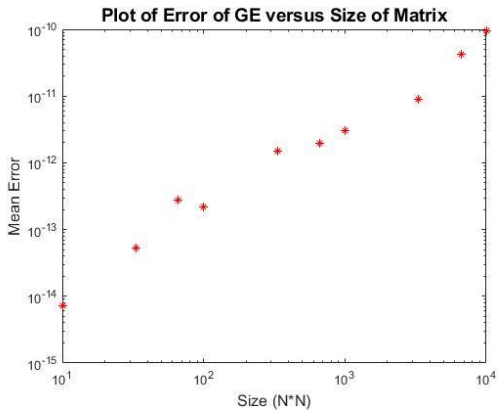

Figure 1

For easier calculation of the approximation of the value for N such that the mean error becomes 1, I use the polyfit function on the $\log_{10}$ values instead, i.e. a line corresponding to the data in Figure 2. Thus, the function for the line is:

$y = 1.2486x - 15.1646$

Since $1 = \log_{10}(10^0)$, we want to find x such that:

$0 = 1.2486x - 15.1646$

$x = 15.1646/1.2486 = 12.14528\ldots$

Thus, for matrices of size $10^{12}x10^{12}$, the mean value of error is approximately 1.

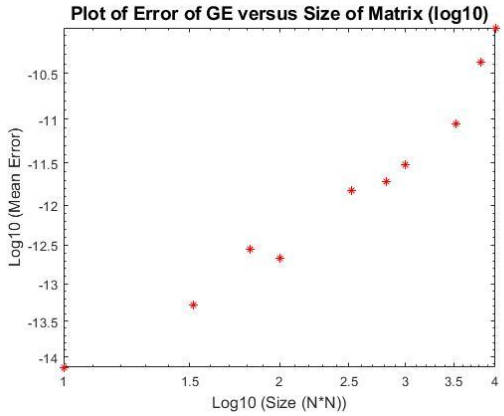

Figure 2