ME 793 - Assignment 1

Department of Mechanical Engineering, IIT Bombay

Spring 2024

Due Date: 8:30 AM, Jan 21, 2024, Marks 20

Assignment Date: 9:30 AM, Monday, Jan 15, 2023

Objective and Instructions

1. The objective is to understand errors associated with calculation and computational cost of $\mathbf{A}^{-1}$ by using various libraries.
2. Show all the elementary steps as needed to fully understand the problem.
3. This needs to be performed using Google Colab Notebook or Jupyter Notebook only.
4. For Assignment 1 you will have to solve using MATLAB and Python both and thus Jupyter notebook alone will not be sufficient. The final comparison and related plots can be made in Jupyter Notebook itself. Total 4 files should be uploaded - MATLAB script, MATLAB script PDF, Jupyter notebook, Jupyter Notebook PDF. Do not submit a zip file.
5. You are *welcome and are encouraged to discuss* with the students of this class.

Q 1. Create random matrices $\mathbf{A}$ of size $n \times n$ where $n = 5, 10, 20, 50, 100$. Try two different programs - MATLAB and Python. Find out:

(a) Which method of calculating inverse is used in the two programs?

(b) Determine the time to compute $\mathbf{A} = \mathbf{LU}$ and $\mathbf{A}^{-1}$ for each case when computing in MATLAB.

(c) Repeat the above in Python using Numpy.

(d) Plot your results using two graphs:

i. Time consumed for $\mathbf{LU}$ decomposition showing two curves of different colors, one for MATLAB and the other for Python. The Y axis will be time in microseconds and the X axis will be n of the matrix.

ii. Plot a similar graph for $\mathbf{A}^{-1}$.

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