

EP 501 Homework 1: Numerical Linear Algebra

September 17, 2019

Instructions: Complete all problems and submit source code and published Matlab results via Canvas.

1. Basic elimination and substitution for linear equations
 - (a) Make a Matlab function that used simple elimination (without pivoting or scaling) - do not use any vectorized Matlab operations - write out all loops explicitly.
 - (b) Write and test a forward substitution function for a lower-triangular system (will be used again in later problems)
2. Matrix inversion methods
 - (a) Alter elimination to work for multiple right-hand sides
 - (b) Implement Gauss-Jordan elimination in a function (you may want to reuse some code from your simple elimination function)
 - (c) Find matrix inverse using Gauss Jordan elimination
 - (d) Compare with builtin and use to solve a system.
3. LU factorization application to solve linear systems
 - (a) Alter your simple elimination function to perform Doolittle LU factorization.
 - (b) Using just the output of the factorization and a back-substitution step, solve a linear system of equations
 - (c) Use LU factors for a system to set up a solution for the same system with a different RHS using forward and backward substitution
 - (d) Show that this process is faster for multiple RHS than performing simple elimination followed by backsubstitution (requires results from 2)
 - (e) Use your LU factorization function to find a matrix inverse.
4. Iterative methods - implement Gauss-Seidel and SOR and do some testing.
5. Determinants
 - (a) Write code or a function to calculate determinant from simple elimination
 - (b) Calculate determinant from Gaussian Elimination function...