

Hand in 6, part 1 of 2 - Matrix Properties

1 Getting acquainted with norms and condition numbers

1. Compute with paper and pen, the 1-norm and the infinity-norm of the matrix that we mentioned during the lecture:

$$A = \begin{bmatrix} 10 & 7 & 8 & 7 \\ 7 & 5 & 6 & 5 \\ 8 & 6 & 10 & 9 \\ 7 & 5 & 9 & 10 \end{bmatrix}. \quad (1)$$

Include the derivation in your hand in.

2. Use `scipy.linalg.norm` to perform the same calculations and check that it is the same. Include your code in your hand in.
3. Compute the condition number of the matrix using
 - (a) `numpy.linalg.cond`
 - (b) `numpy.linalg.norm` (with a norm of your choice)
 - (c) `scipy.linalg.svdvals`

2 Studying the matrix from the ODE-BVP

Consider the BVP that you worked in in the last lab. Which right hand side you choose is not important, as we will study the matrix A .

1. A is A symmetric?
2. Compute, in python, the condition-number of the matrix, for some different number of discretization points N . How does the condition number vary with N (increasing or decreasing)?
3. Look at the eigenvalues of the matrix using `numpy.linalg.eigvals`. Is the matrix positive definite? Negative definite?
4. Can you rewrite your equations to shift the matrix from being positive to negative definite, and vice versa?

5. Use `matplotlib.pyplot.spy` to visualize the sparsity pattern of the matrix A . Include the plot in your hand in.

This should be included in this part of the hand in: From the first section: The derivation, code and answers to questions. From the second section: answers to all questions, and the plot.