

Computational Physics I WS 2017/18

Deadline: Dec 18, 2017

8.1. Norms and conditions of matrices

The condition of a matrix can be determined with the Python routine `cond(A)`, available in the library `numpy.linalg`. The program has a parameter `p` that defines the norm that is used, see

<https://docs.scipy.org/doc/numpy/reference/generated/numpy.linalg.cond.html>

Explain the meaning of the different matrix and vector norms that are described therein.

8.2. Vibrating beams

Develop a finite difference approximation for the vibrations of a beam,

$$\frac{d^4 A}{dx^4} = \kappa^4 A \quad (1)$$

with the boundary condition $A(0) = A(\ell) = 0$ and $A'(0) = A'(\ell) = 0$. Compare the eigenvalues and eigenfunctions with the solutions from problem 3.4.

8.3. Euler constant

The sum $\sum_{n=1}^N 1/n$ diverges logarithmically with N . If the logarithm is subtracted, the remainder converges to a constant, the Euler constant γ , defined as:

$$\gamma = \lim_{N \rightarrow \infty} \sum_{n=1}^N 1/n - \ln N \quad (2)$$

Use finite summations and the Euler-Maclaurin series to estimate the remainder in order to calculate γ .