

Computational Physics Laboratory report

Stefano Ge

Winter semester 2025

Contents

1	Error analysis	1
1.0.1	Approximating exponentials	1
1.2	Floating-point arithmetic and roundoff errors	2
1.2.1	Computing the Basel problem	2
1.3	Error propagation and condition number	2
1.3.1	Computing statistical momenta	2
1.3.2	Condition number: study of a simple algorithm	2
2	Linear systems	2
2.1	Forward- and back-substitution	2
2.2	LUP Decomposition	2
2.3	3
3	Interpolation	3
4	Roots of nonlinear equations	3
5	Numerical integration	3
5.1	Newton-Cotes formula	3
5.1.1	Trapezoidal rule	3
5.1.2	Simpson's rule	3
5.2	Free-nodes integration	3
5.2.1	Nodes and weights of Gauss-Legendre rule	3
5.2.2	Integrals with Gauss-Legendre rule	3
5.3	Advanced topics in integration	3
6	Ordinary differential equations	3

1 Error analysis

1.0.1 Approximating exponentials

Results

Remarks

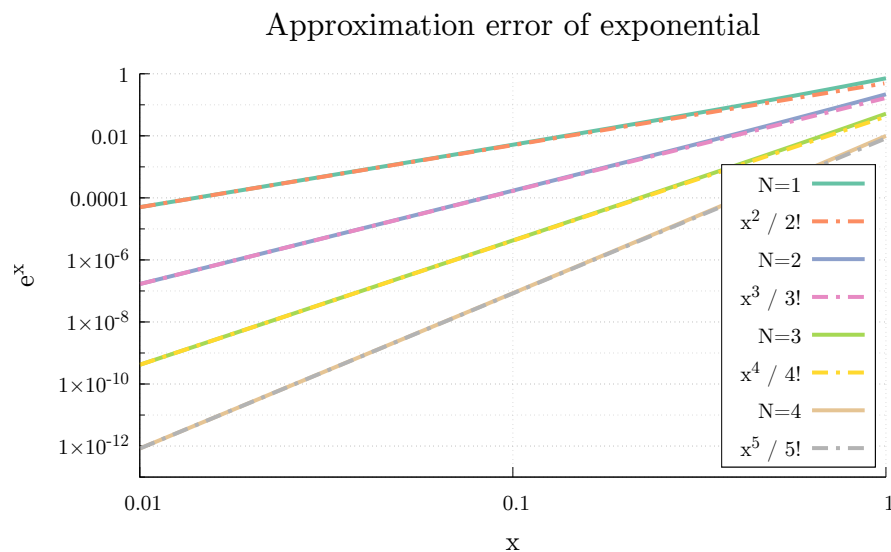


Figure 1: Caption describing the content of the figure.

1.2 Floating-point arithmetic and roundoff errors

1.2.1 Computing the Basel problem

1.3 Error propagation and condition number

1.3.1 Computing statistical momenta

1.3.2 Condition number: study of a simple algorithm

2 Linear systems

test text

2.1 Forward- and back-substitution

2.2 LUP Decomposition

This is test text

2.3

3 Interpolation

4 Roots of nonlinear equations

5 Numerical integration

5.1 Newton-Cotes formula

5.1.1 Trapezoidal rule

test

5.1.2 Simpson's rule

test

5.2 Free-nodes integration

5.2.1 Nodes and weights of Gauss-Legendre rule

something

Remarks

5.2.2 Integrals with Gauss-Legendre rule

5.3 Advanced topics in integration

6 Ordinary differential equations