CSIS
Computer Simulation in Science

Lab Course II, WS 22/23
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Homework 3
due Nov 2, 2022

Exercise 3.1 : Parallelized trapezoidal rule

Implement a parallel program to integrate a function using the trapezoidal rule. Process 0 does the I/O and use `MPI_Send` and `MPI_Recv` to distribute the input and collect the results. Process 0 reads the input from a file. With your program determine π from the the integral

$$\int_0^1 \frac{1}{1+x^2}\, dx = \frac{\pi}{4}.$$

Study the accuracy of your result as a function of the number of trapezoids n. For simplicity, assume that n is a multiple of the number of processes p.

(6 points)

Exercise 3.2 : Timing in MPI

Determine how long your program needs to find the *final* result. How much of this time is spent to add the local integrals?

Study the time estimates as function of the number of processes p. Change p from 2 to 16 by keeping the load of the individual processes constant (*weak scaling*).

Hint: Use the functions `MPI_Wtime()` and `MPI_Barrier(comm)`. (6 points)

Please hand in, together with your working programs, a ***PDF file*** containing their input and output, a plot of the time estimates, and a few comments on your results.