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Summer Semester 2024

Parallel Programming
Assignment 7

Deadline: Monday, July 01, 2024, 23:59 CEST

General Notes:

- This assignment requires to work with the CUDA extensions of C or C++.
- To submit your solutions, follow the instructions given in the course webpage in our Elearning system.

Background: In the OpenMP chapter of the lectures, we had discussed the Gauss-Jacobi method for (approximately) solving large systems of linear equations. In particular, we had derived the sequential form of the algorithm and a parallel version using OpenMP. An MPI version of this algorithm was the topic of Assignment 5; a hybrid version (OpenMP + MPI) was discussed in Assignment 6.

Questions:

1. Implement the Gauss-Jacobi method in CUDA. Try to maximize the amount of work executed on the GPU.

   Modify, if necessary, the termination condition for the Gauss-Jacobi iteration in such a way that the user may input a maximal number of iterations and an upper bound for the difference of two consecutive approximate solutions. The iteration should be stopped as soon as one of these criteria is fulfilled.

   Create a number of large equation systems whose solutions you know and test the program with these systems. Please also upload the input and output of the program to your directories.

   Provide detailed comments explaining the CUDA commands that you use.

   Test your program on the compute node `fang-s009` with

   - 2 blocks and 1024 threads per block,
   - 4 blocks and 512 threads per block,
   - 8 blocks and 256 threads per block.

   Report the results and the run times.

   (600 Points)