PHYS:5905 Final Project

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1. MPI/OpenMP hybrid code: add OpenMP support for the the MPI-enabled HYDRO code.
2. Setup: We run the simulation on a 1024×1024 grid on $[0, 1] \times [0, 1]$, with number of timesteps being 4000 and final time $T = 1.0$. Since the next time step requires information of the current and the previous steps, we only add openmp in each timesteps, but not between timesteps.
3. Validation: Compared the new outputs with the original ones using `diff` (with grid size 128×128). All outputs are exactly the same. We also compared the output of different settings of parallelization with grid size 1024×1024, and the outputs are also the same.
4. Time: We test the program on two 32-core nodes on Argon, with OMP_NUM_THREADS ranging from 32 to 1 while keeping the product of threads and MPI tasks at 64. Figure 1 shows the computational time of the options. Using OpenMP on each MPI task increases the total time cost when the grid size is not very large.

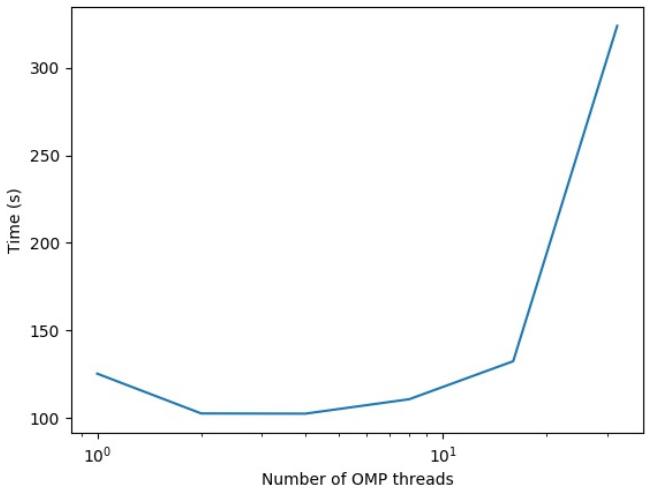

Figure 1: Running time vs. OMP threads

5. I also want to test the same setup with the number of MPI tasks set at 2, but with the different number of OMP threads, which ranges from 1 to 32. I tried to run the whole simulation, but it turned out an error message:

   ——— ORTE has lost communication with a remote daemon.

   HNP daemon : [[29684,0],0] on node argon-itf-cf46-11 Remote daemon: [[29684,0],1] on node argon-itf-cf46-10

   This is usually due to either a failure of the TCP network connection to the node, or possibly an internal failure of the daemon itself. We cannot recover from this failure, and therefore will terminate the job. ———

This happened every time when I try to run the code today, so I have to submit such a non-completed report to meet the deadline. I will try to re-run the code on Wednesday (since I will take a flight tomorrow morning to China), and I will update the results then.