



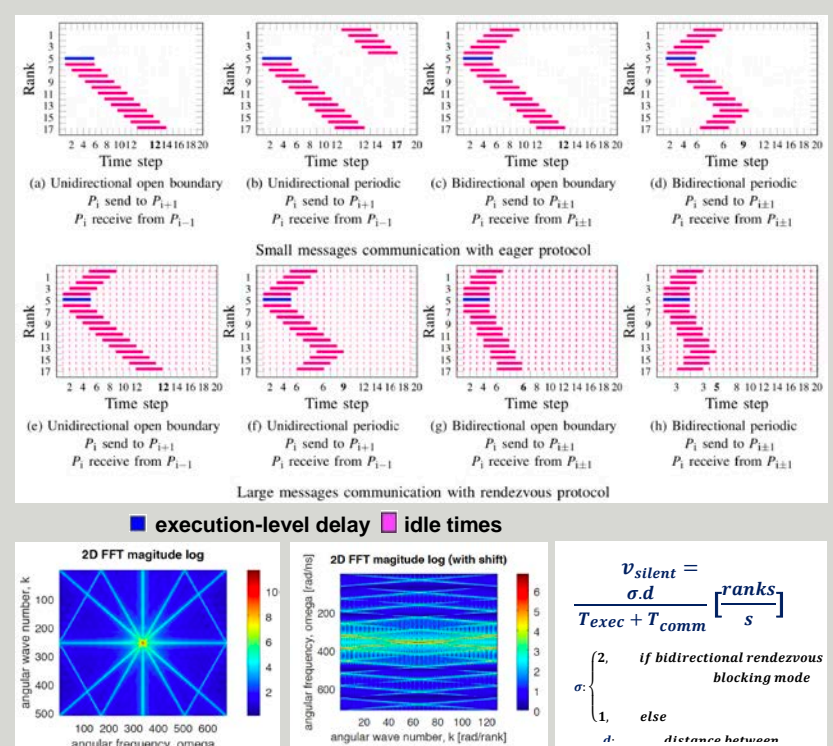
The **High Performance Computing Group** at Erlangen Regional Computing Center (HPC@RRZE) is looking for a

Bachelor/Master thesis student for Modelling and Analysis of Idle Wave Velocity for Composite Distributed Applications

The thesis will be supervised by the HPC group at Erlangen Regional Computing Center, which is led by Prof. Dr. Gerhard Wellein (Department of Computer Science, FAU).

Tasks

Idle waves: Delays originating from different sources propagate across processes of a parallel program running on a cluster. In a regular compute-communicate pattern of a purely compute-bound MPI program, “idle waves” propagate with a definite speed that depends on communication characteristics and execution time. The relevant communication characteristics involve communication times, process topology (open chain vs. closed ring), distance of multiple neighbour communication (direct neighbor, next-to-next neighbor, etc.), direction of communication (uni- vs. bidirectional), communication protocol (eager vs. rendezvous), communication flavor (blocking vs. nonblocking, split-wait vs. wait-for-all), etc. We have an analytic expression for the speed of delay propagation in 1D distributed applications.



Within the bachelor/master thesis, the focus will be in the following areas:

- Getting familiar with the idle wave mechanism and a reproduction of the simpler 1D test cases
- Setting up micro-benchmarks and algorithms on multi-dimensional structured and unstructured grids
- Extension of the analytical model for the propagation velocity of idle waves
 - 1D compute-bound applications to multi-dimensional applications
 - From structured grids towards unstructured grids
- (For master thesis) Analysis of idle waves in frequency space using Fast Fourier Transform (FFT), Fast Wavelet Transform (FWT), etc.

Required skills

- Profound knowledge of C/C++ and code parallelization with MPI and OpenMP
- Basic knowledge in scientific visualization (optional)
- Nature of work: Theory (25%), Conception (25%), Implementation (50%)

Please direct any inquiries or applications to

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