

CSE8803HNC Course Review

Fang (Cherry) Liu Ph.D.

Lecture 1 (Unit01_Part1)

- Pg 9: Discretization
 - for a fixed order, accuracy increases as mesh is refined
 - for a fixed mesh, accuracy increases as the order is raised
 - at least second-order is frequently achieved in practice
 - in recent research targeting many-core machines, we have used up to 32nd order (!)

Lecture 1 (Unit01_Part1)(cont.)

- Pg 17 : CFL stability criterion determines how big time step can be, $\Delta t < \Delta x / c$
- Pg 22 : “flop/s” means “floating point operations per sce”, uses base 10 notation
- Pg32 : Problems with pipelining
 - Requires many independent operations
 - May require partial results to be discarded
 - If pipe is not kept full, the extra hardware is wasted, and machine is slow

Lecture 1 (Unit01_Part1)(cont.)

- Pg42 : Estimating scalability with
 - The concurrent computation
 - The concurrent communication
 - The synchronization frequency
- Pg47 : Moore's Law – number of transistors per chip doubles every 18-24 months
- Pg59 : Simulation driven by price and capability within 20 years
 - Price down from \$2,500,000 to \$8
 - Peak performance raises from 1Gflops to 1.35PetaFlops

Lecture 1 (Unit01_Part1)(cont.)

- Pg61 : problems with parallelism
 - Must find massive concurrency in the task
 - Need many computers
 - Communication between computers becomes a dominant factor
 - Amdahl's Law limits speedup (Pg 62)

Lecture 2 (Unit01_Part2)

- Pg3 : Four steps to create a parallel program
 - Decomposition of computation in tasks
 - Assignment of tasks to processes
 - Orchestration of data access, communication and synchronization
 - Mapping processes to processors
- Co-design, tune the algorithm to the architecture, adjust the algorithm based on performance measuring

Lecture 2 (Unit01_Part2 cont.)

- Pg 8 : Modeling hierarchy
 - Physical world
 - Mathematical model
 - Computational model
 - Solution algorithm
 - Computer code
 - Hardware execution