

GPGPU and CUDA Tutorials

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ARCS 2008 - Architecture of Computing Systems

GPGPU and CUDA Tutorials

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What is this all about

- **GPUs are getting faster, faster**
 - Measured peak of 350 GFLOP/s and 80 GByte/s on a single GPU
- **Paradigm change in scientific computing**
 - Frequency scaling is over, we are now scaling cores
 - Memory wall continues to get worse
- **Manycore architectures**
 - 100s of cores, 1000s of threads in flight in parallel
 - Non-uniform access to memory (NUMA)
- **It's starting now...**
 - 8 core commodity CPUs by AMD and Intel
 - AMD's R670: 320 stream cores
 - NVIDIA's G80: 16 multiprocessors with 8 processors / cores each

Aim and scope

- **This is not about „hacking the GPU“**
 - Languages and programming environments are maturing
 - Do you know how your code scales with 100s of cores?
 - GPUs are forerunners of what future hardware might be like
- **We emphasise**
 - Architecture
 - Fundamental building blocks (of data parallel algorithms)
 - Strategies to achieve good performance
 - Demos and case studies to bring it all together
- **Speakers**
 - Dominik Göddecke (TU Dortmund)
 - Robert Strzodka (Max Planck Institut Informatik)
 - Simon Green (NVIDIA)

Schedule

- **Session 1: 9:30 – 11:00**
 - Introduction
 - GPU architecture (Simon)
 - GPGPU languages (Dominik)
- **Session 2: 11:30 – 13:00**
 - Data parallel algorithms, algorithmic building blocks, precision vs. accuracy (Robert)
 - GPGPU showcases (Robert and Dominik)
- **Lunch**

Schedule

- **Session 3: 14:00 – 15:30**
 - Introduction to CUDA (Simon)
 - CUDA performance (Simon)
- **Session 4: 16:00 – 17:30**
 - Case study: GPU acceleration of parallel multigrid solvers (Dominik)
 - CUDA case studies (Simon)
- **Roundup, summary, open discussion**

Course material

[http://www.mathematik.tu-dortmund.de/
~goeddeke/arcs2008/](http://www.mathematik.tu-dortmund.de/~goeddeke/arcs2008/)

slides, pointers to related material etc.