EE 7700-2

GPU Microarchitecture

Where/When
226 Tureaud Hall, Mon. Wed. Fri. 10:40–11:30 Spring 2012
http://www.ece.lsu.edu/gp/
RSS: http://www.ece.lsu.edu/gp/rss_home.xml

Who
David M. Koppelman, Room 349 EE Building
(225) 578-5482, koppel@ece.lsu.edu
Office hours: Monday–Friday: 14:00–15:00.

Prerequisites
By Topic: Computer architecture and digital logic.
Also, students must also have a familiarity machine language and C++ programming.

Topics
- Basics of 3D Computer Graphics
  Transformations, projections, lighting, textures, etc.
- GPU/GPGPU APIs: CUDA (or OpenCL), OpenGL, Shader Languages, Direct3D
  The rendering pipeline model: vertex/geometry/tessellation/fragment shaders.
  Projects using C/C++ with CUDA (or OpenCL), OpenGL, and OpenGL Shader Language.
- Analysis of 3D Graphics Algorithms and Non-Graphical Algorithms
  Determination of computational and data-transfer needs.
  Determination of control complexity and parallelism.
- Fixed Function and Early Programmable GPU Designs
  Exploitation of control simplicity and abundant parallelism.
  GPU/CPU communication, execution control, and GPU organization.
  Multithreaded execution, latency hiding, and design simplicity.
- Microarchitecture of Modern Programmable GPUs and GPGPUs (Fermi, Kepler, etc)
  Collection-of-SIMD-cores organization and its rationale.
  Memory hierarchy; data sharing, reduction and synchronization capabilities and techniques.
  Knight’s Corner/Crossing (néé Larrabee): Intel’s GPU-like CPU (or CPU-like GPU for Larrabee).
- GPU/GPGPU Algorithms, Performance Measurement, Optimization, and Tuning
  Low-level analysis: machine instructions, hardware event counters.
  Multithreading, memory & register use, and latency hiding.
  Important GPU and GPGPU algorithms.
- GPU Research Topics
  Topics subject to change.

Text

Grading
35% Midterm Exam • 35% Final Exam • 30% Homework and Projects
Final exam weight may be increased for a student who shows significant improvement on the final exam.
Late assignment penalty: 10% per day late deducted. Missed-midterm-exam policy: at instructor’s discretion either a makeup exam, use final exam grade for midterm grade (i.e., 70% final exam weight), or use of zero for midterm grade. Daily attendance: optional, however students are responsible for all material, instructions, and notices presented in class.