

ECE 7861: Scientific Computing on Emerging Architectures

Course Description

Introduction to the architectural system design of emerging architectures and techniques for managing idiosyncrasies of these architectures for developing scientific computing applications.

Prior Course Number: 694.03 or 694J

Transcript Abbreviation: Sci Comp Emer Arch

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Graduate

Student Ranks: Masters, Doctoral

Course Offerings: Autumn

Flex Scheduled Course: Never

Course Frequency: Even Years

Course Length: 14 Week

Credits: 3.0

Repeatable: No

Time Distribution: 3.0 hr Lec

Expected out-of-class hours per week: 6.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites: Prereq: 5362, 762, CSE 2431, or 5431.

Exclusions: Not open to students with credit for 694J or 694.03.

Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.0902

Subsidy Level: Doctoral Course

Course Goals

Introduce the architecture and system design of emerging architectures
Learn techniques for managing architectural idiosyncrasies and programming difficulties associated with these architectural qualities
Learn how to best augment/alter the designs of these systems to minimize the programming cost of future revisions of the hardware
Introduce students to emerging architectures, such that they become exposed to the exciting developments in the field

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction to emerging architectures	3.0							
GPU programming with CUDA threads, registers, streaming operations	3.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
CUDA hardware review - memory system overview	3.0							
CUDA optimizations - memory, control flow, floating point math	5.0							
Student paper presentations	5.0							
Heterogeneous multicore CPUs - case study: Cell BE Architecture	5.0							
Optimizations for heterogeneous multicore CPUs - double buffering, SIMD, branch elimination	3.0							
Programming heterogeneous platforms with OpenCL	3.0							
Multithreaded architectures - performance analysis and optimizations	3.0							
Application case studies	4.0							

Representative Assignments

Performance evaluation assignments by running important kernels/codes on specific architectures (such as Matrix-Matrix Multiplication in CUDA, OpenCL, Cell etc)
Code/kernel optimization assignments on specific architectures
Review of the literature
Term paper projects: oral presentations and written reports.

Grades

Aspect	Percent
Homeworks	30%
Paper Presentation	15%
Progress Report	10%
Term Project Report	30%
Term Project Presentation	15%

Representative Textbooks and Other Course Materials

Title	Author
<i>No textbook is required. Handouts will be distributed electronically.</i>	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
**	a	An ability to apply knowledge of mathematics, science, and engineering.
*	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.

Course Contribution		College Outcome
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Updated description, prereqs, exclusions, goals and topics to conform to university format 3/29/12

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