

# CS-622: Advanced Computer Architecture Seminar - Fall 2005

**Instructor: Dmitry Ponomarev**

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Class web page: <http://www.cs.binghamton.edu/~dima/cs622>

Class meeting times: Tuesdays, 6 - 9 pm

## **Course description and format:**

While the traditional performance-oriented architecture research is perhaps on a life support, the use of ever smaller transistor feature sizes, increase in the density of integrated circuits and the use of higher clock frequencies open up new exciting avenues for research. Such important issues as power, temperature, reliability and security are receiving a great deal of attention by the architecture research community these days. *This year, half of the course will be in the form of lectures, and half of the course will be in the form of students' presentations and subsequent discussions based on recent key papers from top architectural conferences.*

## **Course objectives:**

To present a broad overview of current active research topics in computer architecture

To reinforce the understanding of the design and the implementation of modern microprocessors.

To gain hands-on research experience

## **Tentative list of topics to be covered:**

- Microarchitectural support for security
- Techniques for copying with soft errors
- Power, energy and temperature-aware architectures. Power-performance trade-offs.
- Multiclustered, multithreaded and multicore architectures
- Scalable processor designs with large instruction windows
- Microarchitectural support for software debugging
- Microarchitectural techniques for reducing the inductive noise in microprocessors
- Data prefetching techniques
- Trace caches and trace-based optimizations
- Program phase detection techniques and phase-based optimizations

## **Reading materials:**

We will mainly rely on recent research papers from the top architecture conferences. Readings for each week will be posted on the class web page. For each assigned paper, students will have to turn in a critique (one page document) at the beginning of the class when the paper is discussed. Each student will also present several of these papers in class.

## **Final project**

The semester-long final project will be the most important part of the course from both the educational and the grading perspectives. The default project is to design and evaluate a non-trivial extension to an existing technique or propose and evaluate a new idea along the lines of the material discussed in class. Projects can either be done individually or in groups of two.

## **Tools**

We will be using the various microarchitectural simulators (SimpleScalar, SESC) and related power and timing analysis tools (Wattch, Cacti).

## **Grades:**

Final project – 60%

Critiques and analysis of papers - 20%

Presentations and class participation – 20%

**Prerequisite:** CS-522 (or cs-325 if taken with me)