

CS 491/591 Robust Physical Computation

UNM Computer Science / Ackley
/ 8/22/05

Class location: FEC141

Class time: M 1-4

Instructor: David Ackley

Office hours: M 4-5; W 11-3

Instructor email: ackley@cs.unm.edu

Office location: FEC349D

Class web site: <http://www.cs.unm.edu/~ackley/491>

Overview

Guided exploration and research on topics related robust physical computation, organized as a hands-on studio course, and emphasizing awareness of the creative processes involved in robust system design. In consultation with the instructor, the student will be responsible for everything from the initial choice of task focus, to studying the literature, to implementing robust software and hardware as needed, to characterizing the resulting system, to presenting the machine and results, and providing useful critiques of other's efforts.

Prerequisites

- CS241 and CS251, or equivalent programming experience and familiarity with C/C++.
- Strong interest in programming and exploring robust computational systems.

Course work

There are three principal course work elements:

- A semester-long research and development project selected and performed by each student individually. A working system will be presented by the student before the end of the semester, and a research paper is due the last day of class, presenting the choice of topic, relevant related work, the machine design and refinements, empirical data obtained from the machine, and discussion and conclusions.
- Approximately three times during the semester, each student will present for critique an update in class on the status of and new developments in their project. All students will be evaluated for their *responses* to other student's critiques, as well as for their own presentations.
- Once during the semester, each student individually will present a 'robustness spotlight talk' on the robustness properties of some real-world system, selected by the student in consultation with the instructor.

Grading

We are seeking both to gain research experience in general and to advance understanding in robust computational design specifically, and in particular in the context of the hardware selected for this course. This is a collaborative and cooperative class, not a competitive one; it is not graded on a curve. Although each student will be the sole 'head' of their own project, their contributions to others' work in the class is just as valuable. Impact

For success what we are seeking is *impact*, which can be accomplished in many ways—producing interesting demos, sharing code, listening actively and offering useful suggestions and

constructive criticism, contributing background materials and ideas, and so on. Regular class attendance is a requirement.

Midway through the semester each student will receive feedback about their impact, mentioning any particular strengths or areas of concern.

Research project

The principal coursework is a semester-long research and development project selected by the student in consultation with the instructor, and then conducted by the student individually, with help from the class and instructor where possible. Research projects will be evaluated in part by how well they manifest the principles of robust physical computation—so which can sometimes be at odds with (often efficiency-dominated) notions of quality in some fields of computation.

Regardless of the specific outcomes of each research and development project, we expect steps such as:

- From a broad area within robust physical computation, sharpening a research focus and determining what is *not* relevant to the work;
- Study the literature for prior work and approaches to the area of investigation;
- Designing a feasible approach, and implement and debug it on the selected hardware;
- Designing experiments and gathering data about the system behavior, and likely modifying or improving the system based on the observed data.
- Writing up the results and presenting the project to the class.

All code, parameter values, and so forth needed to recreate the results presented in the final project paper must be turned in as part of the final project.

Critiques

The main purposes of the research update critiques ('crits') are:

- To gain experience in presenting research-in-progress;
- To learn from each other;
- To gain experience providing feedback, reactions, and suggestions for research-in-progress;
- To help ensure progress continues throughout the semester.

Note that providing constructive feedback to other student's research updates is as important as one's own research update presentations.

Class attendance

As a seminar class focusing heavily on interactions among all participants, reliable on-time class attendance is a critical course element. To encourage this, the class attendance policy is:

1. Missing a class, or arriving more than 45 minutes late, counts as an *absence*.
2. Arriving more than 5 minutes late, but less than 15 minutes late, counts as a *lateness*.
3. Arriving 15-45 minutes late counts as one *lateness* per 15 minutes, rounding all fractions up.
4. Each three *latenesses* (from either one or multiple class meetings) counts as one *absence*.
5. Each *absence* after the first two reduces the maximum possible overall course grade by one

letter grade – so three total *absences* during the semester would yield a maximum course grade of B+, four *absences* yields C+, and so on.

Robustness Spotlight Talk

The robustness spotlight talk may focus on a particularly robust system of interest to the student, or on particular failures of robustness, or some combination. It is emphatically not limited to obviously computational contexts—on the contrary, the more diversity in topics within the class, the better.

There have been many spectacular system failures that, at least in retrospect, we can see how the might have been avoided by robust system design. The purpose of the robustness spotlight talks is to remind us that robustness or its lack is not a property limited to computer systems, and to help us tease out and understand common principles leading to robust systems or failures thereof.