

Computational Fabrication

Menu

SCHEDULE SYLLABUS ASSIGNMENTS STUDENT WORK

RESOURCES ▾ DISCUSSION

Menu

Syllabus

Spring 2021

CS 491 and 591: Computational Fabrication, Special Topics in Computer Science

Meeting Time: Tuesday and Thursday 12:30 – 1:45pm

Zoom Location: <https://unm.zoom.us/my/handandmachine>

Course Description

Computational fabrication integrates programming, design, and digital fabrication. Computational fabrication enables people to design forms by writing code and then construct these forms with the aid of fabrication machines like 3D printers, CNC routers, knitting machines, and laser cutters. In this class, we will explore different approaches to computational design, as well as a range of fabrication machines, materials, and techniques. Students will explore topics through regular hands-on assignments, readings, and discussions with peers. Students will gain expertise primarily through creative experimentation with computation, design, and fabrication.

Students will be introduced to computer-aided-design (CAD) software for 2D and 3D design along with programming environments aimed at the design of physical artifacts. In particular, we will use LOGO, Processing, Python, Grasshopper, and Rhino. The course will introduce essential mathematical topics in geometry, calculus, and linear algebra. We will examine different 2D and 3D file formats and explore the process of converting digital designs into physical form through computer-aided machining (CAM). The course will also cover foundational design principles and introduce students to the practice of design critique.

Learning Objectives

Students should leave the course with an ability to design and fabricate computationally generated 2D and 3D forms. Students should have a basic understanding of computational fabrication as an emerging research topic in computer science as well as a powerful set of approaches that can be applied in art and design contexts. Students should also learn foundational design skills and be able to participate in constructive design critiques.

Grading

Assignments: 60%

Class participation: 30%

Final project: 10%

The class participation component of your grade will include attendance and class participation as well as engagement with online discussions and critiques, which are described in more detail below. Small Assignments are worth 25 points and Large Assignments (shown on the schedule in orange) are worth 100 points. Most assignments will take the form of posts on this website that document artifacts you have made. Each of these assignments, including the final project, will be assessed along four equally weighted dimensions:

- **Overall Design:** The conceptual and aesthetic design of your project. This dimension is about your fundamental design or design idea—how compelling and original it is. It is less focused on how well your design is ultimately executed. Note: aesthetic design is not about whether I like the way your design looks. It is a measure of how thoughtful and consistent

your aesthetic approach is. You should be intentional about all choices you make that impact the look of your design.

- **Craftsmanship, Artifact:** The care and attention paid to the physical construction of your project. A beautifully crafted artifact is intrinsically compelling. A poorly crafted one leaves you few opportunities to convey anything meaningful.
- **Craftsmanship, Code:** The care and attention paid to the code that generates your design. Good code is organized, well commented, and easy for others to read and understand. Note: you will not be graded on the complexity or sophistication of your code.
- **Documentation: Images and Writing:** The care and attention paid to the documentation of your project. Your images should be beautiful: you should use appropriate lighting and take pictures of artifacts against a simple background or in a thoughtful and appropriate context. Excellent documentation is essential to communicating and sharing your work.

Course Structure

All classes will take place over zoom during our regularly scheduled class time, Tuesday and Thursday from 12:30-1:45pm. In person attendance, with your video turned on, is essential.

There are a total of six Large Assignments, and corresponding in-class critique sessions, over the course of the semester. Each student will present their work for critique during at least two critique sessions. We will dedicate 10 minutes of class time for each project being discussed during a critique session. On weeks that Large Assignments are due, due dates are as follows:

Sunday: Assignments are due by the end of the day.

Tuesday: Comments on peer posts are due by the end of the day.

Wednesday: List of students who will present work on Thursday is sent out.

Thursday: In-class critiques take place.

Critique Guidelines

A large part of this class will involve engaging with and reflecting on the work of your peers and also listening to and reflecting on peer feedback you receive. These engagements will take the form of online discussions on this website as well as in-person discussions. Critique sessions will be structured as follows:

- **Permission to Comment.** Some people enjoy talking and sharing their opinions, others are more quiet and reserved. To make sure that everyone participates equally in critique sessions, students are allowed to comment on another student's work only after receiving an invitation.
- **Participation is Expected.** You are expected to actively participate in each critique session. Please come prepared with thoughtful reflections, particularly for projects that you were assigned to comment on. I may also ask you to comment on any work that is being presented.
- **Chat Disabled.** During critique sessions, zoom chat will be disabled. This is to insure that all of our immediate attention is focused on the in-person (kind of) interaction. If you feel compelled to make a comment, please do so on the project post on the class website. The student artist will be able to read your comment and respond after class.

The purpose of engaging with someone else's work is to learn something from it, to try to understand the intentions of the creator and how these are communicated in the artifacts they built. You should approach other students' work with an open mind and the assumption that they were (a) intentional in making the design choices they did and (b) you can learn something from them. Analyzing someone else's work also provides opportunities for you to learn about yourself. What draws you to some designs and not others? What can you learn from your own reactions about what makes a design exciting, beautiful, or unsettling? To encourage constructive conversations, written and in-person critiques for this class should follow these guidelines:

- **Comment on the work, not the person.** All comments should focus on the project being discussed, not the person presenting the work. It is important to very clearly separate these two things. For example instead of saying something like "You seem to like x", say "This piece uses x". Comments on a person's appearance or demeanor are especially inappropriate.

- **Thoughtful and specific compliments.** Find one or more specific aspects of the work that you admire and articulate why it captures your attention and interest. This is the heart of your critique, your written or in-person comment.
- **Questions.** Ask at least one question to help you understand the intent of the designer and their approach. What they are intending to convey through their design? What techniques did they use to accomplish their goals? What do they seem to find compelling or interesting and why?
- **No negative comments.** If you have a negative reaction, stop and think about why you are responding in this way. Use your negative reaction as an opportunity to learn about yourself and your understanding of design. ie: why is something “ugly”? What makes something seem unfinished, poorly crafted, or uninteresting? If you feel it is important to express your thoughts, do so in the form of a question.
- **No suggestions.** If you have an impulse to suggest a way to make something “better”, use it as an opportunity to reflect on what “better” means to you. Does better mean...symmetrical, simpler, more algorithmically complex? Why are these qualities compelling? Again, if you are tempted to make a suggestion, find a way to express yourself in the form of a question.

Late Days

Turning in work on time is important. Online discussions and critique sessions depend on timely submissions. I also appreciate that life can be complicated and difficult. You will have a budget of three late days over the course of the semester. You can use them all at once or for three different assignments. If you use up your entire budget, you can submit late assignments but you will lose 10 points for each day they are late. You will also lose an extra 15 points for being more than two days late because this means you will not be able to participate fully in the discussion process. To be clear, here are the points available to you in this scenario: one day late: 90points; two days late: 80 points; three days late: 65 points, etc.

Working Together

Working together is highly encouraged. You just need to email Leah and get her permission before working collaboratively on any assignment. You are also encouraged to use the internet to solve programming challenges and find inspiring examples. Cite the sources you use and find helpful. Use examples wisely. You should understand each line of code or component in your program and be able to use it in other contexts.

Academic Integrity

Academic Dishonesty (also known as cheating or plagiarism) occurs when someone – knowingly or unknowingly – presents the words, ideas, or code of another person as his or her own. Any work turned in for this class must meet UNM's standards for academic integrity or academic honesty (<https://policy.unm.edu/regents-policies/section-4/4-8.html>).

Accessibility

Please contact the Accessibility Resource Center if you expect to need academic accommodations for this class.

The ARC is there to help you. If you have a condition where, for example, you need extra time or a quiet place for exams, I strongly recommend that you take advantage of their services. In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as I am not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 or <https://arc.unm.edu/> for additional information.

If you need an accommodation based on how course requirements interact with the impact of a disability, you should contact me to arrange an appointment as soon as possible. At the appointment, we can discuss the course format and requirements, anticipate the need for adjustments and explore potential accommodations. I rely on the Disability Services Office for

assistance in developing strategies and verifying accommodation needs. If you have not previously contacted them I encourage you to do so.

Title IX

Title IX prohibitions on sex discrimination include various forms of sexual misconduct, such as sexual assault, rape, sexual harassment, domestic and dating violence, and stalking. Current UNM policy designates instructors as required reporters, which means that if instructors are notified (outside of classroom activities) about any Title IX violations, they must report this information to the Title IX coordinator. However, the American Association of University Professors' (AAUP) "Statement on Professional Ethics" requires that Professors protect students' academic freedom and "respect[s] the confidential nature of the relationship between professor and student." Therefore, as a Professor I have pledged to honor student confidentiality and will strive to respect your wishes regarding reporting. If you or someone you know has been harassed or assaulted and would like to receive support and academic advocacy, there are numerous confidential routes available to you. For example, you can contact the Women's Resource Center, the LGBTQ Resource Center, Student Health and Counseling (SHAC), or LoboRESPECT. LoboRESPECT can be contacted on their 24-hour crisis line, (505) 277-2911 and online at loborespect@unm.edu. You can receive non-confidential support and learn more about Title IX through the Title IX Coordinator at (505) 277-5251 and <http://oeo.unm.edu/title-ix/>. Reports to law enforcement can be made to UNM Police Department at (505) 277-2241.

Credit Hour Statement

Federal Credit Hour Definition: A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than: (1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work,

internships, practica, studio work, and other academic work leading toward to the award of credit hours.

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