USC Viterbi
School of Engineering

Course ID and Title: CSCI599: Special Topics - Geometric Shape Modeling
Units: 4
Term—Day—Time: Spring 2024 — Tuesday/Thursday — 3:30-5:20pm

Location: GFS228
Website: odedstein.com/teaching/fs-2024-csci-599

Instructor: Oded Stein
Office: SAL 344
Office Hours: Thursday, 11am-12pm
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Teaching Assistant: TBD
Office: TBD
Office Hours: TBD
Contact Info: TBD

Catalogue Description
Introduces students to the basics of modern geometry processing. Students will learn surface reconstruction, animation, parametrization, deformation, and meshing.

Course Description
In this class students will learn the basics of modern geometry processing with applications in computer graphics and computer-aided fabrication. Students will get an overview over the whole geometry processing pipeline and many of its important tools, from the acquisition / creation of surfaces, the manipulation of surfaces, the texturing of surfaces, and the output of surfaces. Our focus will always be on shapes in 3D, which we view as manifolds from differential geometry on which we solve algebraic and differential equations.
As a final project, students will implement a recent geometry processing research paper, demonstrating their full mastery of modern geometry topics.
This course is adapted from Alec Jacobson's geometry processing course at the University of Toronto (github.com/alecjacobson/geometry-processing-csc2520).

Learning Objectives
Students will be proficient with a standard research geometry processing library, and will be able to use it to write C++ geometry processing applications.
Students will understand and be able to implement a variety of modern geometry processing methods in surface reconstruction (marching cubes, Poisson surface reconstruction), surface registration (iterative closest point), surface deformation (Laplacian deformation), and surface parametrization (Tutte parametrization, least-squares conformal mapping, as-rigid-as-possible).
Students will have completed their own geometry processing project in C++, demonstrating mastery of the above mentioned methods.

Prerequisite(s): Linear Algebra (MATH 225 or MATH 471), Calculus & Vector Calculus (MATH 125g, 126g, 226g), C++ (CSCI 431), Algorithms (CSCI 270)
Co-Requisite(s):
Concurrent Enrollment:
Recommended Preparation:

Course Notes
Letter grade. Graded assignments & final project.

Technological Proficiency and Hardware/Software Required
Students must be proficient in C++. Students must have a computer with a graphics card that can compile and run C++ code with OpenGL.

Required Readings and Supplementary Materials
All readings will be available as course notes.

Description of Assignments and How They Will Be Assessed
All weekly assignments are coding assignments that will be graded by a TA, based on whether the required exercises have been solved correctly and the code performs as instructed.
The final project will include code as well as a writeup.

Participation
Participation in in-class discussion contributes to a percentage of the final grade. Regular participation in in-class discussions during the course of the class is sufficient to obtain the maximum grade. The instructor will prepare a log at the end of each lecture-based class.

Grading Breakdown

Assessment Tool (assignments)	% of Grade
Weekly assignments	60
Final project	30
In-class performance	10
TOTAL	100

Grading Scale

Course final grades will be determined using the following scale

A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Assignment Submission Policy

Assignments are to be submitted via Blackboard/Brightspace at the indicated due date. Assignments can not be submitted late. Late assignments are considered not submitted.

If there are extenuating circumstances that mean you can not submit an assignment, please contact the instructor as soon as possible to see if alternative arrangements can be made.

Course-Specific Policies

[Add any additional policies that students should be aware of: late work submissions, missed classes, use of technology in the classroom, etc. Course-specific policies differ from university policies in that they are set by each instructor or department/program.]

Attendance

You can skip one week's worth of classes without any impact to your grade if you inform the instructor in advance. If you need any further accommodations, please contact the instructor as soon as possible to see if alternative arrangements can be made.

Academic Integrity

Unless otherwise noted, this course will follow the expectations for academic integrity as stated in the USC Student Handbook. The general USC guidelines on Academic Integrity and Course Content Distribution are provided in the subsequent "Statement on Academic Conduct and Support Systems" section.

For this class, you are allowed to discuss the assignments with your fellow students, but each student must complete the assignment and write the code independently. Do not share code with your classmates while you complete the assignments. Ever student must submit their own assignments. Submitting code written by somebody else is considered plagiarism.

Students can not collaborate on final projects. Every student must have their own final project.

If students are found responsible for an academic integrity violation, students may be assigned university outcomes, such as suspension or expulsion from the university, and grade penalties, such as an "F" grade on the assignment, exam, and/or in the course.

Please ask the instructor [and/or TA(s)] if you are unsure about what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

You may not record this class without the express permission of the instructor and all other students in the class. Distribution of any notes, recordings, exams, or other materials from a university class or lectures — other than for individual or class group study — is prohibited without the express permission of the instructor.

Use of Generative AI in this Course
A) Generative AI is not permitted: Since creating, analytical, and critical thinking skills are part of the learning outcomes of this course, all assignments should be prepared by the student working individually or in groups as described on each assignment. Students may not have another person or entity complete any portion of the assignment. Developing strong competencies in these areas will prepare you for a competitive workplace. Therefore, using AI-generated tools is prohibited in this course, will be identified as plagiarism, and will be reported to the Office of Academic Integrity.Course Evaluations

Course Schedule

This course has a final project. This course has no final exam.

	Topics/Daily Activities	Readings/Preparation	Deliverables
Week 1 Jan 8	Introduction to the course and the course format		HW1 (getting familiar with the programming environment) assigned
Week 2 Jan 15	Surface representations Surface reconstruction	Course notes on website	HW1 due HW2 (surface reconstruction) assigned
Week 3 Jan 22	Surface alignment & registration	Course notes on website	HW2 due HW3 (surface registration) assigned
Week 4 Jan 29	The Laplacian & Bilaplacian	Course notes on website	HW3 due
Week 5 Feb 5	Smoothing	Course notes on website	HW4 (smoothing) assigned
Week 6 Feb 12	Geometry simplification	Course notes on website	HW4 due HW5 (decimation) assigned
Week 7 Feb 19	Subdivision	Course notes on website	HW5 due HW6 (subdivision) assigned
Week 8 Feb 26	Mappings & Jacobians	Course notes on website	HW6 due
Week 9 Mar 4	Shape deformation	Course notes on website	HW7 (shape deformation) assigned
Spring recess Mar 11			
Week 10 Mar 18	Parametrization	Course notes on website	HW7 due HW8 (parametrization) assigned
Week 11 Mar 25	Distance computation	Course notes on website	HW8 due HW9 (distances) assigned
Week 12 Apr 1	Curvature	Course notes on website	HW9 due HW10 (curvature) assigned
Week 13 Apr 8	Discussion of final projects		HW10 due **Final projects assigned**
Week 14 Apr 15	Guest lecture		
Week 15 Apr 22	Presentation of final projects (no class on Tuesday)		**Final projects due**
FINAL	**final project**		

Statement on Academic Conduct and Support Systems

Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Course Content Distribution and Synchronous Session Recordings Policies
USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Students and Disability Accommodations:
USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (regis-

tration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - *(213) 740-9355 – 24/7 on call*
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - *988 for both calls and text messages – 24/7 on call*
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - *(213) 740-9355(WELL) – 24/7 on call*
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - *(213) 740-5086*
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - *(213) 740-5086 or (213) 821-8298*
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - *(213) 740-0776*
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - *(213) 740-0411*
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - *(213) 740-2101*
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - *UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*

Non-emergency assistance or information.

[Office of the Ombuds](#) - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - *(323) 442-2850 or* otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.