TEXAS A&M UNIVERSITY

Course Syllabus

Course Information

Course Number: CSCE 450
Course Title: Computer Animation
Section: 200/500
Time: TR 11:10-12:25
Location: HRBB 113
Credit Hours: 3

Instructor Details

Instructor: Shinjiro Sueda
E-Mail: sueda@tamu.edu
Office: Peterson 405
Office Hours: M 1p-2p, W 2p-3p
Zoom: link

TA: Ryan Zesch
E-mail: rzesch@tamu.edu
Office: Peterson 402
Office Hours: T 4p-5p, R 1p-2p, F 12p-1p
Zoom: link

Course Description

This course investigates computational problems in computer animation. This course is about learning the mathematical and algorithmic foundations behind various techniques used for computer animation for real-time and offline use.

Course Prerequisites

Co-requisites: CSCE 441 and (CSCE 315 or 331); or permission of the instructor.

Course Learning Outcomes

At the end of the course, students should be able to:

- Make use of 3D rotations including quaternions
- Apply key-frame interpolation of positions and orientations
- Choose which spline curves to use for different applications based on continuity requirements
- Compute curve tangents, curvature, Frenet frames, and arc-length parameterization
- Apply regression and curve fitting
- Use Gaussian quadratures for definite integrals
- Evaluate linear blend skinning on the CPU and the GPU
- Apply bilinear/trilinear interpolation for 2D/3D mesh deformation
- Apply blend shapes for 3D facial animation
- Implement gradient descent and Newton's Method with line search to solve inverse kinematics
- Compare path-finding algorithms
- Apply numerical integration schemes for ordinary differential equations
- Model particle systems
- Develop a cloth simulation system with collisions

Textbook and/or Resource Materials

There is no textbook, but we will make use of several sources for course material. Besides notes from lectures, we will use several articles and notes available online.

We will be using Canvas for assignment submission and EdSTEM [https://edstem.org/us/join/uBtK4n] for announcements and discussions.

Grading Policy

The grade will be based on participation and programming assignments.

- [70% of grade] There will be 5 programming assignments, each due about every two weeks.
    - Code Documentation: All code must be turned in. Although the code itself may not be examined in great detail, it may be examined to verify the way it was implemented. It is your responsibility to make sure that the code is understandable.
- [20% of grade]
    - An open-ended final programming project.
    - Mandatory milestones: proposal, midway report, final presentation, final webpage.
- [10% of grade] Participation: interact with the instructor at least once per week during class, during office hours, or online.

Final course grades will be based on the following scale:

- A = 90% and above
- B = 80%-89.999%
- C = 70%-79.999%
- D = 60%-69.999%
- F = <60%. Also, all the milestones for the final project must be met to pass the course.

Late Work Policy

All assignments/milestones are due on canvas at 23:59. All assignments must be submitted on time. However, you get 6 free days for the entire semester which can be applied to any of the programming assignments. You do not need to explain why you are using the days—these late days will be automatically applied to any late assignments. The free days will be given out in increments of full days. Exceptions will be given for excused absences (see Student Rule 7).

Course Schedule

The following schedule for the lectures and assignments may (and will) change—it is meant to serve as a basic outline of topics and schedule.

T 8/23 R 8/25	Introduction; Matrix stacks review	
T 8/30 R 9/1	OpenGL review; Interpolation and curves; Cubic splines	
T 9/6 R 9/8	Quaternions; Arc-length parameterization; Time control and cubic fit	
T 9/13 R 9/15	Gaussian quadrature; Linear blend skinning	Assignment 1
T 9/20 R 9/22	More linear blend skinning; Bilinear interpolation	
T 9/27 R 9/29	Blendshapes and facial animation; Differential properties of curves; Tensor product surfaces	Assignment 2
T 10/4 R 10/6	Intro to numerical optimization; Gradient descent, line search, Newton's method	
T 10/11 R 10/13	Inverse kinematics	Assignment 3
T 10/18 R 10/20	Intro to physics-based animation; Numerical integration	

T 10/25 R 10/27	Implicit Euler with multiple particles; Cloth simulation	Assignment 4
T 11/1 R 11/3	Collision detection; Dynamic Collisions; Sparse matrices	
T 11/8 R 11/10	Intro to continuum mechanics; Material models	Assignment 5
T 11/15 R 11/17	Path finding; Project one-on-one conferences	
T 11/22 R 11/24	Project one-on-one conferences	
T 11/29 R 12/1	Guest lecture (TBD); Smoothed-particle hydrodynamics	
T 12/6	Project help	
F 12/9	**3p – 5p** Project presentations	Final Project

University Policies

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

This course does not have a textbook, and so missing class might cause you to miss key material. You should not expect help with material if you missed class when it was covered. Also, some of the more interesting parts of the course come from student questions (this also helps keep the instructor from jumping too far ahead, too fast); you need to be in class to participate in this!

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at https://aggiehonor.tamu.edu.

To emphasize and clarify these points, note that any aspect of passing another's ideas, words, writings, etc. off as your own is an example of an honor code violation. If you use any outside source in the completion of your assignments (besides the instructor and materials distributed as part of the course), you need to acknowledge that fully and clearly, as well as the extent of assistance received (e.g., did you ask for help finding a bug from someone, or did you copy/download someone's code, etc.). Note that using such sources could still result in a lower assignment grade (if you did not do parts of the work yourself), but by acknowledging that help, you avoid a violation of the honor code. Note also that a full and clear acknowledgment does not mean burying a reference to help in submitted code, or any-thing similar. Use of outside sources should be acknowledged both during the in-class demonstration (if applicable), as well as in clear, easy-to-find locations in your submission.

It is common (and in fact good) practice to use external libraries for basic operations such as linear algebra, numerical optimization, etc. When you use such libraries, you are responsible for being sure that you are following the appropriate use guidelines, and that you acknowledge their use. For assignments, there is usually a list of key items that are desired in the assignment. Those items should not be accomplished via library functions – you are expected to implement them yourself.

Many of the sources we link to are copyrighted, and you should ensure that you follow appropriate restrictions in their use. Also, please note that the course materials, including in-class notes, linked notes, the contents of the website, etc. are copyrighted, and may not be reproduced for purposes beyond your coursework without permission.

If there are any questions or concerns about whether an action is appropriate, you should check with the professor first. If in doubt, assume that it is not appropriate.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit https://disability.tamu.edu. Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must

report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see University Rule 08.01.01.M1):

The incident is reasonably believed to be discrimination or harassment.

The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, you will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with Counseling and Psychological Services (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing the resources and services available from Counseling & Psychological Services (CAPS). Students who need someone to talk to can call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24- hour emergency help is also available through the National Suicide Prevention Hotline (800- 273-8255) or at https://suicidepreventionlifeline.org.

Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, Texas A&M University has adopted policies and practices for the Fall 2020 academic term to limit virus transmission. Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, help sessions, transitioning to and between classes, study spaces, academic services, etc.):

- Self-monitoring—Students should follow CDC recommendations for self-monitoring. **Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.**
- Face Coverings—Face coverings (cloth face covering, surgical mask, etc.) must be properly worn in all non-private spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain. Description of face coverings and additional guidance are provided in the Face Covering policy and Frequently Asked Questions (FAQ) available on the Provost website.
- Physical Distancing—Physical distancing must be maintained between students, instructors, and others in course and course-related activities.
- Classroom Ingress/Egress—Students must follow marked pathways for entering and exiting classrooms and other teaching spaces. Leave classrooms promptly after course activities have concluded. Do not congregate in hallways and maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.
- To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student

to leave and join the class remotely. If the student does not leave the class, the faculty member should report that student to the Student Conduct office for sanctions. Additionally, the faculty member may choose to teach that day's class remotely for all students.

Statement Regarding Vaccines and Face Coverings

To help protect Aggieland and stop the spread of COVID-19, Texas A&M University urges students to be vaccinated and to wear masks in classrooms and all other academic facilities on campus, including labs. Doing so exemplifies the Aggie Core Values of respect, leadership, integrity, and selfless service by putting community concerns above individual preferences. COVID-19 vaccines and masking — regardless of vaccination status — have been shown to be safe and effective at reducing spread to others, infection, hospitalization, and death.

Personal Illness and Quarantine

Students required to quarantine must participate in courses and course-related activities remotely and **must not attend face-to-face course activities**. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities.

Students experiencing personal injury or Illness that is too severe for the student to attend class qualify for an excused absence (See Student Rule 7, Section 7.2.2.) To receive an excused absence, student must comply with the documentation and notification guidelines outlined in Student Rule 7.