CSE 5543 (Approved): Geometric Modeling

Course Description

Common algorithmic and mathematical techniques for modeling geometric objects in computer graphics and CAD applications; sample based modeling, mesh generation, and hierarchical representations.

Prior Course Number: CSE 784
Transcript Abbreviation: Geom Modeling
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Math 2568 or Math 568 or Math 571
Exclusions: Not open to students with credit for CSE 784
Cross-Listings:

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.0901
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
BS CSE	BS Computer Science and Engineering
MS CSE	MS Computer Science and Engineering
PhD CSE	PhD Computer Science and Engineering

Course Goals

Master modeling curves and surfaces (B-splines and Bezier)
Master techniques for object creation, manipulation with extrusions, revolutions, lofting
Master techniques to generate meshes from point cloud data and CAD data
Be familiar with hierarchical representations
Be exposed to parameterization techniques

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Curve modeling (B-splines and Bezier)	5.0							
Subdivision curves	3.0							
Surface geometry and topology	3.0							
Surface modeling (B-splines and Bezier)	4.0							
Subdivision surfaces	4.0							
B-rep, CSG, Boolean operations	3.0							
Curve and surface reconstruction	5.0							
Surface and volume simplification	5.0							
Mesh generation	5.0							
Parameterization	3.0							
Midterm examination, review, discussions	2.0							

Representative Assignments

Model Bezier and B-spline curves with various methods and user interfaces
Generate control polyhedra from the curves in Lab 1 above and several object generation techniques
Use the control polyhedra generated in Lab 2 above to generate subdivision surfaces
Remesh the surface generated in Lab 3 above with meshing and simplification techniques

Grades

Aspect	Percent
Lab assignments	35%
Midterm	25%
Final	30%
Class participation	10%

Representative Textbooks and Other Course Materials

Title	Author
Geometric Modeling	Mortenson
Course Notes	Tamal Dey

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
*	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.

Course Contribution		College Outcome
	g	An ability to communicate effectively.
*	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
*	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

BS CSE Program Outcomes

Course Contribution		Program Outcome
**	a	an ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, and engineering;
*	b	an ability to design and conduct experiments, as well as to analyze and interpret data;
**	c	an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as well as appropriate constraints related to economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations;
	d	an ability to function on multi-disciplinary teams;
*	e	an ability to identify, formulate, and solve engineering problems;
	f	an understanding of professional, ethical, legal, security and social issues and responsibilities;
	g	an ability to communicate effectively with a range of audiences;
*	h	an ability to analyze the local and global impact of computing on individuals, organizations, and society;
*	i	a recognition of the need for, and an ability to engage in life-long learning and continuing professional development;
*	j	a knowledge of contemporary issues;
**	k	an ability to use the techniques, skills, and modern engineering tools necessary for practice as a CSE professional;
***	l	an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;
***	m	an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;
**	n	an ability to apply design and development principles in the construction of software systems of varying complexity.

Prepared by: Tamal Dey