CSC 572 Computer Graphics (graduate level)

Syllabus

Professor: Zoë Wood
Office: Building 14, room 209
Phone: 756-5540
office hours: T&Th 11-12 (W 2-3 online)
email: zwood@calpoly.edu
Schedule: T-Th lecture 3:10-4:30 lab 4:40-6:00pm
Location: lecture: 14-250 lab: 14-303

General: This course will expose you to research in computer graphics related to geometric models (acquisition, reconstruction, representation, enhancement: simplification, representation, and texturing). **This course requires substantial math and programming skills.** In particular it will be helpful if students are familiar with linear algebra and writing 3D computer graphics programs in OpenGL.

Assignments:

- One in class presentation about a current research paper from the instructor provided list of papers (20% grade)
- One larger final programming project of the student's choice approved by the instructor. (35% grade)
- Weekly quizzes or lab assignments related to the lecture material and papers. (35% of grade)
- Participation in seminar discussions! (10% grade)

Text: We will be primarily reading research and survey papers published in computer graphics related journals and conferences. See next page for the list of papers.

The following is a ***tentative*** schedule for topics and assignments

Week 1	9/23/08	Orientation and introduction	
	9/25/08	Introduction to surface representation	
	Read	*Implicit Surfaces (Bloomenthal)*	Lab 1
Week 2	9/30/08	Model acquisition: intro to volumes	
	Read	*Marching cubes (Lorenson & Cline)*	Quiz 1
	10/2/08	Model acquisition:VRIP	
	Read	*Vol. Method for Build (Curless & Levoy)*	Lab 2
Week 3	10/7/08	Model acquisition: VRIP continued	
	Read	*Real-time 3D model Acq (Rusinkiewicz, et. al.)*	Quiz2
	10/9/08	Model acquisition: alignment I	
	Read	*Non-Rigid Range Scan (Brown, et. al)*	Final proj proposal mtgs
Week 4	10/14/08	Model acquisition: alignment II	
	Read	*Global Non-rigid alignment (Brown, et. al)*	Quiz 3
	10/16/08	Model Acq. & representation: IBR	
	Read	*Modeling & Render Arch (Debevec, et. al.)*	Quiz 4
Week 5	10/21/08	Enhancement: simplification	
	Read	*Progressive Meshes (Hoppe)*	Lab 3
	10/23/08	Enhancement:simplification	
	Read	*Surface Simp using quad (Garland, et. al)*	Quiz 5
Week 6	10/28/08	Enhancement:simp & representation	
	Read	*Dual contouring of Hermite (Ju, et. al.)*	Lab 3 continued
	10/30/08	Enhancement: repair	
	Read	*Robust Repair of Polygonal Models (Ju)*	Quiz 6
Week 7	11/4/08	Surface rep: NURBS & subdivision	
	Read	*Sub-div course notes & book **TBA***	Lab 4
	11/6/08	Surface rep: NURBS & subdivision	
	Read	*Sub-div course notes & book **TBA***	Lab 4 continued
Week 8	11/11/08	**Academic Holiday**	
	11/13/08	Surface rep: NURBS & subdivision	
	Read	*Sub-div course notes & book **TBA***	Final proj. check-in
Week 9	11/18/08	Enhancement: simp & representation: MRA	

	Read	*Multires. Analysis of Arb. Meshes (Eck, et. al)*	
	11/20/08	Enhancement: representation: NURBS	
	Read	*Fitting Smooth Surfaces (Krishnamurthy & Levoy)*	Final proj check-in
Week 10	11/25/08	Enhancement: representation: Normal maps	
	Read	*Gen. method for preserve. attribute(Cignoni, et. al)*	
	11/27/08	**HOLIDAY**	
Week 11	12/2/08	*Geometry Images (Gu, et. al)*	Final project check-in
		Enhancement: representation: GIMs	Quiz 7
	12/4/08	**Field trip to UCSB or guest lecture (TBA)**	
Final	12/9/08	**Tuesday 4:10-7pm**	**Final In class assessment**

We will be reading the following papers for this class:

Implicit Surfaces by Jules Bloomenthal p 1-18 **(surface representation intro.)**

Marching Cubes: A High Resolution 3D Surface Construction Algorithm, William E. Lorensen and Harvey E. Cline; SIGGRAPH '87 **(representation volume)**

A Volumetric Method for Building Complex Models from Range Images, Curless & Levoy; Siggraph 1996 **(acquisition)**

Real-Time 3D Model Acquisition, Szymon Rusinkiewicz, Olaf Hall-Holt and Marc Levoy, , SIGGRAPH 2002 **(acquisition)**

Non-Rigid Range-Scan Alignment Using Thin-Plate Splines. Benedict Brown and Szymon Rusinkiewicz Symposium on 3D Data Processing, Visualization, and Transmission. September 2004. **(acquisition & enhancement)**

Global Non-Rigid Alignment of 3-D Scans. Benedict Brown and Szymon Rusinkiewicz. ACM Transactions on Graphics (Proc. SIGGRAPH). 26(3) August 2007. **(acquisition & enhancement)**

Progressive Meshes, Hugues Hoppe, Siggraph 1996
(surface representation/enhancement:simplification)

Surface Simplification using Quadric Error Metrics, M. Garland and P. Heckbert, SIGGRAPH 1997 **(enhancement:simplification)**

Dual Contouring of Hermite Data, Ju, Losasso, Schaefer & Warren; SIGGRAPH 2002
(volume representation/enhancement:simplification)

Robust Repair of Polygonal Models,T. Ju, , *SIGGRAPH 2004* **(enhancement: repair)**

Some chapters and notes provided about curves, NURBS and subdivision surfaces

Multiresolution Analysis of Arbitrary Meshes, Eck, DeRose, Duchamp, Hoppe, Lounsbery & Stuetzle, SIGGRAPH 1995 **(enhancement: represenation)**

Fitting Smooth Surfaces to Dense Polygon Meshes, Krishnamurthy and Levoy, SIGGRAPH 1996 **(enhancement: represenation)**

Modeling and Rendering Architecture from Photographs: A Hybrid Geometry- and Image-Based Approach, Debevec. P., Taylor, Malik, Siggraph 1996 **(acquisition & representation:IBR)**

A general method for preserving attribute values on simplified meshes, P. Cignoni, C. Montani, C. Rocchini, R. Scopigno, IEEE Visualization 1998 **(enhancement: represenation)**

Geometry images, X. Gu, S. Gortler, H. Hoppe, *SIGGRAPH 2002* **(enhancement: represenation)**

If time permits we may also look at:

Efficiently Combining Positions and Normals for Precise 3D Geometry, D. Nehab, S. Rusinkiewicz, J. Davis, R. Ramamoorthi, Siggraph 06 **(enhancement: representation)**
Or
Time-Varying Surface Appearance: Acquisition, modeling and Rendering, J. Gu, C. Tu, R. Ramamoorthi, P. Belhmeur, W. Matusik, S. Nayer, Siggraph 06 **(alternative represenation)**

Interactive Decal Compositing with Discrete Expoential Maps, R. Schmidt, C. Grimm, B. Wyvill, Siggraph 06 **(enhancement: texturing)**
Or
Mesh Quilting for Geometric Texture Synthesis, K. Zhou, X. Huang, X. Wang, Y. Tong, M. Desbrun, B. Guo, H-Y Shum, siggraph 06 **(enhancement: texturing)**