



Course Syllabus: Special Topics: Geometry Processing - CS 390E

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	CS 390E
Course Title	Special Topics: Geometry Processing
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	01:00 PM - 02:30 PM Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Peter Wonka	Peter.Wonka@kaust.edu.sa	+966128080235 8080235		by appointment: peter.wonka@kaust. edu.sa

Teaching Assistant(s)

Name	Email
Jens Schneider / Liangliang Nan	TBD

Course Information

Comprehensive Course Description	<p>The course content are various topics related to geometry processing:</p> <ul style="list-style-type: none"> *) A review of computer graphics, mesh data structures (e.g. the half-edge data structure) *) A short introduction to matlab (which will be used for the programming assignments) *) A review of basic linear algebra and a lot of applied linear algebra. Many problems in geometry processing lead to linear systems or Eigenvalue problems. *) An introduction to discrete differential geometry. How to estimate normal vectors, curvature, ... *) Mesh smoothing. How to generate a smooth mesh out of a mesh with noise, e.g. from scanned data *) Subdivision surfaces. Given a coarse input mesh, how to define refinement rule to generate smooth higher resolution meshes that approximate or interpolate the input mesh. *) Parametrization. Given a mesh in 3D, how can we map the polygons into 2D without self-intersections while preserving polygon shapes as much as possible? *) Remeshing. Given a polygonal mesh, how can we represent the same surface by a different mesh. The discussed remeshing algorithms aim to control the number of polygons, polygon shapes, and irregular vertices in the output mesh. *) Mesh Simplification. Given an input mesh, how can we generate simplified versions of the mesh by iteratively removing polygons? *) Model Repair. Given a polygonal mesh with defects (e.g. holes), how can we repair the polygonal mesh (e.g. fill holes)? *) Laser Scanning and Reconstruction from Point Clouds. Given a set of points, how can we reconstruct a polygonal mesh from the set of points? *) Mesh Deformation. Given an input mesh, how can we specify and subsequently compute a mesh deformation? *) Procedural Modeling. How can we model a large amount of content using procedural methods? *) Vector and Tensor Fields on Surfaces. Given an input mesh, how can we interpolate a vector, tensor, or cross field from given user input?
Course Description from Program Guide	
Goals and Objectives	<p>The goal of this course are to learn the basics of geometry processing.</p>
Required Knowledge	<p>The course requires programming skills and mathematics skills (linear algebra, calculus, calculus of variations, differential geometry, optimization). Many of the advanced mathematical topics will be covered in the course, but good foundations in at least calculus and linear algebra are necessary.</p>
Reference Texts	<p>Polygon Mesh Processing Mario Botsch, Leif Kobbelt, Mark Pauly, Pierre Alliez, Bruno Levy available online from the library</p>
Method of evaluation	<p>10.00% - Homework /Assignments 90.00% - Course Project(s)</p>
Nature of the assignments	<p>The projects are about programming algorithms in matlab. The assignments are mainly reading assignments + answering some questions.</p>
Course Policies	<p>TBD</p>
Additional Information	<p>N/A</p>

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/23/2017 Thu 01/26/2017	Topic 1
2	Mon 01/30/2017 Thu 02/02/2017	Topic 2
3	Mon 02/06/2017 Thu 02/09/2017	Topic 3
4	Mon 02/13/2017 Thu 02/16/2017	Topic 4
5	Mon 02/20/2017 Thu 02/23/2017	Topic 5
6	Mon 02/27/2017 Thu 03/02/2017	Topic 6
7	Mon 03/06/2017 Thu 03/09/2017	Topic 7
8	Mon 03/13/2017 Thu 03/16/2017	Topic 8
9	Mon 03/20/2017 Thu 03/23/2017	Topic 9
10	Mon 03/27/2017 Thu 03/30/2017	Topic 10
11	Mon 04/03/2017 Thu 04/06/2017	Topic 11
12	Mon 04/10/2017 Thu 04/13/2017	Topic 12
13	Mon 04/17/2017 Thu 04/20/2017	Topic 13
14	Mon 04/24/2017 Thu 04/27/2017	Topic 16
15	Mon 05/01/2017 Thu 05/04/2017	Topic 15
16	Mon 05/08/2017 Thu 05/11/2017	Topic 16
17	Mon 05/15/2017 Thu 05/18/2017	Topic 17:
18		Topic 18: A list of topics is given in the course description.

Note

The instructor reserves the right to make changes to this syllabus as necessary.