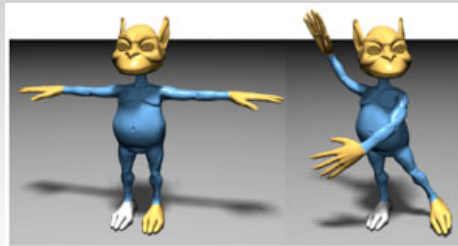
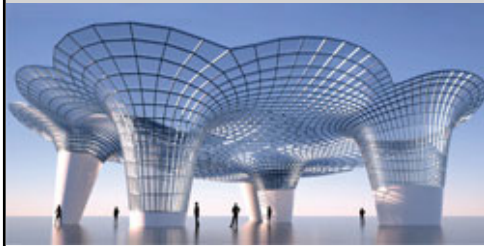


CPSC 424 Geometric Modeling



Alla Sheffer



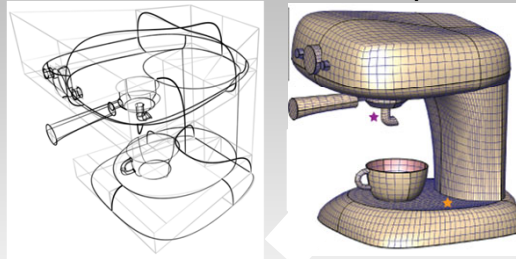
© Wolfgang Heidrich & Alla Sheffer

What is Geometric Modeling?

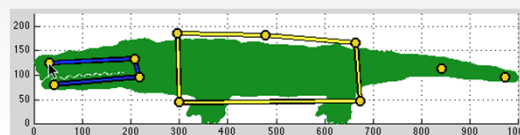


- Creation & Editing of Virtual 3D Shapes

Creation



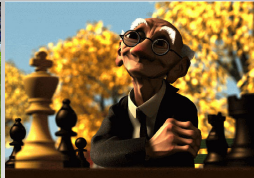
Editing



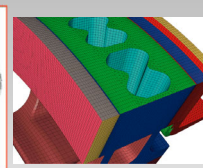
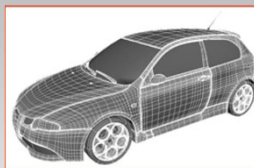
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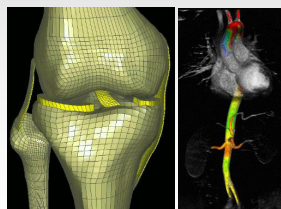
What is it used for?



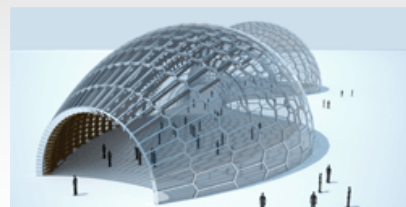
Games/Movies



Engineering/Fabrication



Medicine/Biology

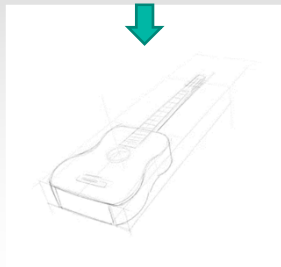


Architecture

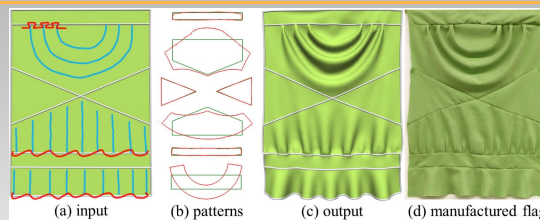
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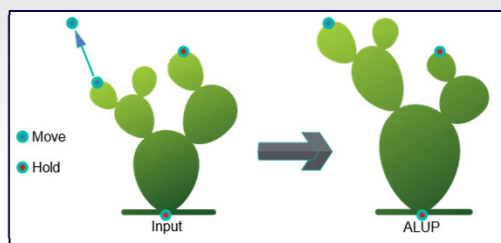
State of the Art (very partial)



Modeling Interfaces



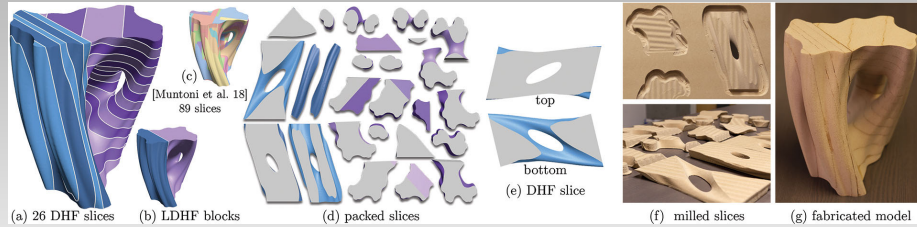
Fabrication



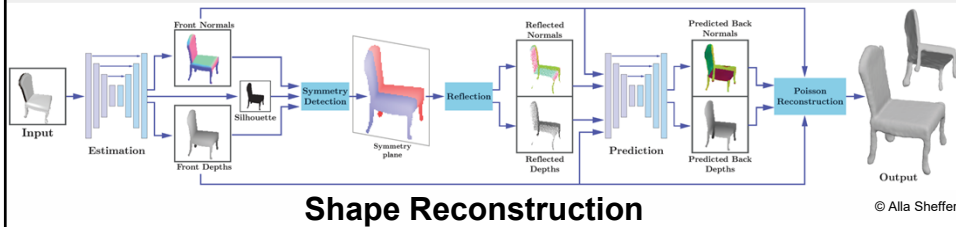
Editing

© Alla Sheffer

State of the Art (very partial)



Fabrication

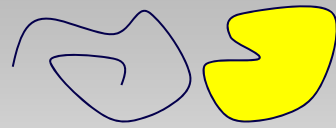


Shape Reconstruction

Topics Covered:

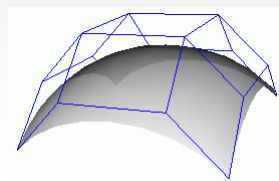
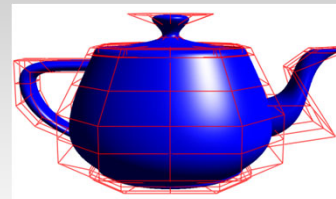
Curves and Surfaces

- Representations of geometry
- Mathematical foundations
- Algorithms
- Data structures



Emphasis:

- Parametric curves and surfaces
 - Bezier, Splines
- Subdivision
- Polygon meshes
- Implicits
- Applications





Topics NOT Covered:

Interesting but no time:

- Fractals, iterated function systems, etc.
- Procedural geometry

Fine Arts topics:

- Artistic issues
- How to use a geometric modeling package

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Course Format

Lectures:

- Monday, Wednesday, Friday, 12PM-1PM, DMP 301

Tutorials:

- TAs: Camilo Talero, Chenxi Liu, Yibo Jiao, Xuze Peng
- Mon 1PM-2PM (**EOS 135**) or Mon 2PM-3PM (DMP 101)

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Prerequisites

CS:

- CPSC 320 (may be waved)

MATH:

- one of MATH 152, MATH 221, MATH 223
- one of MATH 200, MATH 217, MATH 226, MATH 253.

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Resources

Web:

- <https://www.students.cs.ubc.ca/~cs-424/>
- Piazza discussion forum (link from course page)
 - Note: **!!!! Contact me ASAP if you have privacy concerns re direct use of PIAZZA !!!!**
- Canvas: quizzes + grade reporting

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Resources

Textbooks:

- **Optional:**
 - *Curves and Surfaces in Geometric Modeling: Theory and Applications* (J. Gallier, Morgan Kauffmann)
 - *Polygonal Mesh Processing*, Botsch, Kobbelt, Pauly, Alliez, Levy, AK Peters

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Grading System

30% Final

- **Must pass** to pass course

30% (15% + 15%): Midterms

- (Probably) October 7 and November 16, in class

20%: Two programming assignments

- WebGL/C++/OpenGL, templates provided
- https://www.students.cs.ubc.ca/~cs-424/assn_index.html
- Grace day policy (more later)

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Grading System

13%: Written/MATLAB assignments

- Details will be posted at
https://www.students.cs.ubc.ca/~cs-424/assn_index.html
- Theoretical/MATLAB coding
- Due Monday or Friday, **at start of class**
 - Use handin for MATLAB
 - Can use handin for written assignments (but limits feedback)
- Discussed in subsequent tutorials
- **Crucial for midterms & final!!**

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Grading System

7% Participation++

- Weekly quizzes (3%) + Review questions (2%) + In class participation (2%)

Weekly Quizzes (3%)

- Do-at-home multiple choice quiz
- Starting from week three
- Typically selected from the questions posted by students as part of the weekly review (next slide)
- Posted on **Canvas** Tue due Fri noon (same week)
- **Some of these questions will be on midterms/final**

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Grading System

Review Questions (2%)

- Submit one question per week
 - *via private Piazza message*
 - *Due Monday noon*
- Based on material covered *the week before*
- Each submission needs to include:
 - *question*
 - *four+ multiple choice answers*
 - ***explanation of correct answer***
- If your question is selected for a quiz your grade for the quiz containing it will **double**. If two of your questions are selected, the grade will **triple**.

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Grading System

Class Participation (2%)

- Q & A
 - *Points for asking/answering questions in class*
- Clicker questions
 - *On average 1 per class (often in first 5min...)*
 - *Credit for participation not correctness*
- **Written notes**
 - *Points for uploading (good) class notes to Piazza*

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Grading System

[!!!! Bonus 5% !!!!!]

- **Hard** (and time/student # limited) bonus questions
- Asked in class
- Answered via **private** piazza posts or email

**!!!! Credit for assignments + participation
can go above 40% !!!**

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TODO

Webpage

- Read
- Comply with policies

Piazza

- Register

iClicker

- Register/install

A1:

- Read

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Decorum (respect your classmates)



Please come on time & stay till end of class

- Coming/leaving disrupts everyone *even if done quietly*
- Hint: we will have clicker questions near start/end

Please no open screens unless specifically asked by instructor

- Very disruptive for folks sitting behind you

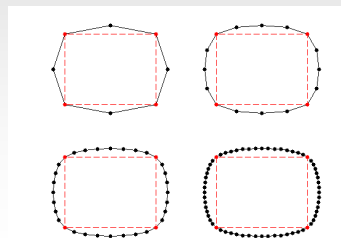
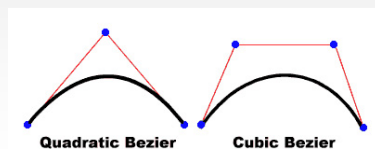
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Syllabus (I)



Curves in 2D and 3D

- Implicit vs. Explicit vs. Parametric curves
- Bézier curves, De Casteljau algorithm
- Continuity
- B-Splines
- Subdivision Curves



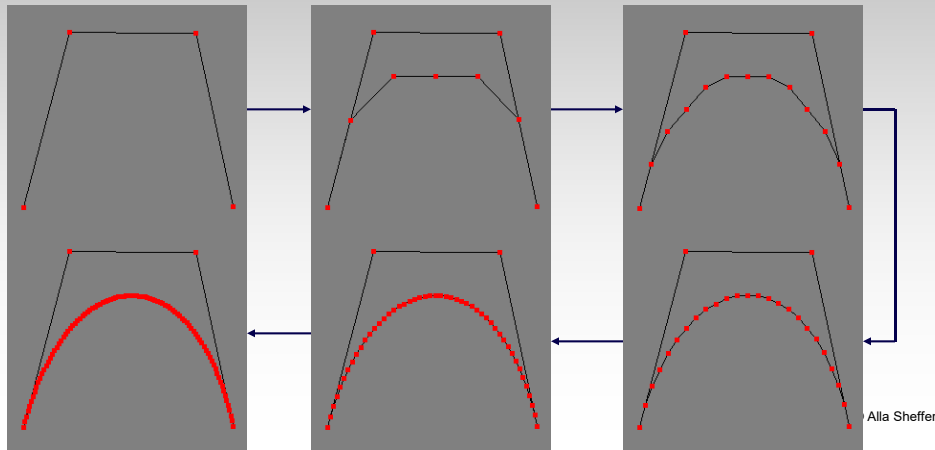
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Syllabus (I)

Curves in 2D and 3D

- Example (Bézier curve through recursive subdivision):



Syllabus (I)

Curves in 2D and 3D

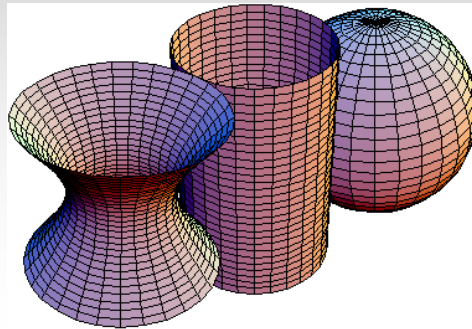
- Example – curves in PowerPoint

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Syllabus (II)

Properties of Curves and Surfaces

- Elementary Differential Geometry
- Fresnet Frame
- Curvature (Gauss, min/max...)
- Discrete curvature

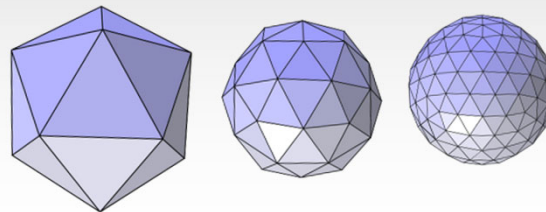
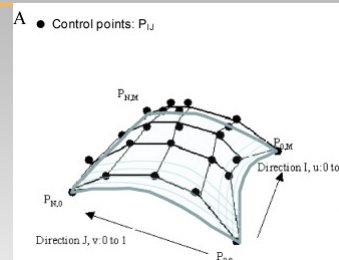
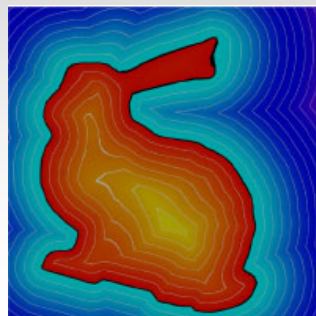


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Syllabus (III)

Surfaces

- Tensor product surfaces
- Subdivision surfaces
- *Implicit Surfaces*



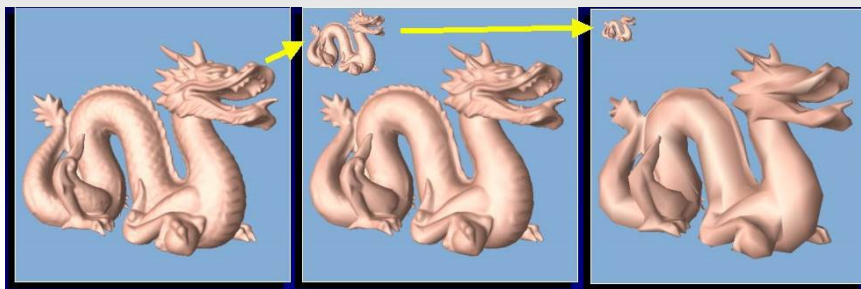
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Syllabus (IV)

Polygonal Meshes

- Data structures
- Processing
 - *Simplification*
 - *Parameterization*



Syllabus (V)

Advanced Topics

- Modeling for fabrication
- Modeling Interfaces
- ***Other (you pick)***



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