Welcome to CS838!
Topics In Computing: Advanced Computer Graphics
Fall 2015, 2:30-3:45 MW
Today’s lecture

- Discuss scope of class, and indicative topics
- Clarify class logistics
  - Communication mechanisms
  - Assignments
  - Evaluation procedure
- Give an example of a topic that **YOU** might present in class
  - Significant part of your evaluation
  - An opportunity to sharpen communication & presentation skills
- (Time permitting …) a few details about your instructor
- Next lecture:
  - *First topic : Point-based modeling (and reading assignment due!)*
What is the class about?

- Gaining *exposure* to modern computer graphics principles
- Covering fundamentals, at enhanced depth
- Also a taste of current trends (in research or industry)

Who is this class for?

- Accessible by graduate students in all areas
- Advanced (post CS559) undergrads, too
- Prior exposure to visual computing is assumed
- Should be somewhat comfortable with programming
- Enthusiasm a must!
• Modeling and geometry
  • Point-based models
  • Implicit surfaces
  • Meshing
  • Mesh optimization and processing
  • Differential geometry
• Rendering
  • Global illumination
  • Rendering equation - radiosity
  • Photon mapping
  • Image-based rendering
• Shape manipulation
  • Laplacian mesh processing
  • Shape morphing
  • Non-rigid registration
  • Parameterization
• Animation
  • Character skinning
  • Facial animation
  • Motion editing and control
  • Performance-driven animation
Topics

• Dynamics
  • Cloth animation
  • Contact & collision
  • Rigid body simulation
  • Intro to fluids simulation
• Various cool stuff
• Sound modeling
• Interactive rendering
• Shape synthesis
• General-purpose GPU use
Logistics

- Location: Computer Sciences 1257, MW 2:30-3:45pm
- 3 units, core credit eligible
- Course website: http://pages.cs.wisc.edu/~cs838-1
  - Check for lecture notes, announcements & weekly assigned readings
- Office hours: CS6387 MW 10:00-11:00am
  - Regular office hours only on days when class meets (excl. holidays)
  - Other times by appointment
- Mailing list: comsci838-1-f15@lists.wisc.edu
  - Please email the instructor if you are not automatically enrolled (e.g. auditing)
- Online discussion: Piazza (post here for your reading assignment!)
- Email policy:
  - Typically within 24hrs
  - Worst case: you will get a reply by the time of next office hours
  - Use piazza whenever possible
• 3 parts ("loosely" equally weighted)
  • Reading assignments, In-class Presentation, Project

• Reading assignment
  • Due: day before first class of every week (usually Sunday, but Tuesday for next week)
  • Submit on Piazza!
  • Part I: A 1-2 paragraph summary of one of the papers you were assigned to read
  • Part II: Eight questions/comments/points of critique
    • Each about 1-3 sentences
    • Can be a question you had when reading the paper
    • Or an observation (not explicitly given in the paper)
    • Or an answer to another student’s question
• 3 parts ("loosely" equally weighted)
  • Reading assignments, In-class Presentation, Project
• Presentation assignment (example to follow)
  • Starting week 3
  • Each student presents once, 15min slot.
  • Must prepare and run by instructor at least 1 week ahead of time.
  • List of papers & signup forms : to be posted on webpage
• Programming project
  • Individual (unless an exceptional case arises)
  • Open-ended, with guidance from instructor.
  • 2 progress milestones (end of Sept, end of Oct)
  • Deliverable : last week of classes
• No final
Preparing a presentation assignment
Untangling Cloth (ACM SIGGRAPH 2013)

David Baraff, Andrew Witkin and Michael Kass
Pixar Animation Studios
Overview

• Cloth simulation is an extremely popular effect in feature films
In simple and concrete terms (minimal jargon), what does the paper do?

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- Collisions are what makes cloth behavior exciting

Bridson et al, SIGGRAPH 2002

(c) Monsters Inc
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- Cloth simulation is an extremely popular effect in feature films
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- We don't want tangling, but sometimes it's unavoidable
- This method allows simulation to tolerate & recover from tangles

(c) Monsters Inc

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(try to explain why we even care about this!)
How did we arrive at this problem? What have others done to deal with it?

Popular (prior) approaches:
- Option A: Make sure nothing is ever tangled

Bridson et al, SIGGRAPH 2002
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- Option A: Make sure nothing is ever tangled

Harmon et al, SIGGRAPH 2009

Bridson et al, SIGGRAPH 2002

How did we arrive at this problem? What have others done to deal with it?
Popular (prior) approaches:

- Option A: Make sure nothing is ever tangled
- Option B: Keep history of what side the cloth “came from”
Challenges

- Animation constraints often trigger deep interpenetration
- Not always clear how a tangled scenario should resolve

Why is this problem difficult? (why was this solution a research paper?)
Approach

- Compute the *curves* along which surfaces intersect
- Identify regions enclosed by such curves (flood fill)
- Color each curve (and associated region) based on connectivity

Summarize the technical approach (be intuitive; use math only if really necessary)
Approach

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Summarize the technical approach (be intuitive; use math only if really necessary)
Special case:
- Sometimes intersections curves don’t form a closed loop!
- … but by “rewinding” the model to its reference shape, a closed loop can be discovered! (still, this is the most challenging scenario)
Response:

- Make “nearby” collided locations on different sides attract to one another (by a spring-like attraction force, built into the physics simulation)
- Goal: Encourage 2 sides to meet in the middle & reduce collision.
Response:

- Make “nearby” just-cleared locations on different sides repel one another (by a spring-like attraction force, built into the physics simulation)
- Goal: Discourage an imminent collision from happening anytime soon.
Approach

Response:

• Don’t do anything for instances with “open” intersection curves (curves that were open prior to pulling them back)

• Difficult to define what “meeting in the middle means” (but we hope that the intersection won’t be all that visible in such cases)

Summarize the technical approach (be intuitive; use math only if really necessary)
Show examples of the technique in action (or performance numbers, if that is the goal)
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You may add (time permitting …)

- Follow-up work that you came across
- Critique (your own, or from papers read) of the strengths and weaknesses for the paper just presented
- Videos (when applicable)
- Discussion points you want to volunteer

Try avoiding …

- Too many equations, especially copied verbatim from paper
- Not discussing why we care about this paper
- Assuming that everyone knows as much about the paper as you do (it’s ok to assume things already discussed in class)
- Dwelling in procedural implementation details (be careful … sometimes the implementation might be among the most interesting aspects of the proposed method)
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Research interests:

- Physics-based modeling
- Digital humans
- Simulated elastic objects
- Fluid animation
- Fracture & destruction
- Fast math in general
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