CIS 563: Physically based animation

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Final Projects

Final Project - What is it?

- A project of your choice
  - groups of 1-3 people
  - can use existing code (need to clearly state it)
  - part of your system can be existing code but you will also need to **implement your own physically-based animation code**
  - need to get your project approved by Ladislav via email (one per group is fine)
  - First come, first served: project topics can be taken
  - Some project ideas discussed later in this class

Grade

- 60% homework
- 36% final project
- 4% class / piazza participation

Bottom line:

- Grade does not matter that much at the end of the day
- Career: industry / academia (PhD) / startup

Important Dates

03/28: Teams Formed and Project Topic Decided. Submit to Canvas.

04/21 & 04/23: Final Project presentations (in class). 25% of Final Project grade.

04/30: Last day of classes

05/07: Final Project = Paper + code + video due. (Submit to Canvas)

No late days for Final Projects:

submitted late = 0 points

Project Topic

- Project title & abstract (1 paragraph)
- Include names of all team members
  - For projects with 2 or 3 members, choose one person who will be “point of contact” (PoC)
  - Only PoC will submit project description on Canvas (others do not submit anything)

Last year's Final Projects

- Ishaan: http://vimeo.com/85072666
- Sijie: https://www.youtube.com/watch?v=2w8HkfCvqJs
- Lucy: http://youtu.be/SN9ydFbR1QU

Prelude to Master's thesis

- Research-type projects
- CIS 563 Final project can be used as springboard for Master's thesis project
  - Re-using your final project code, models etc. is allowed
- Unique opportunity to try research
  - Without having to commit to a PhD program
- Nathan: http://youtu.be/cBVCbSq_7rI

Research-type projects

Projection-based Dynamics

- Our paper accepted to SIGGRAPH 2014
- Code is not public (VirtaMed company)
- Re-implement and make it public!
- Tiantian will provide starter code

Anatomically accurate mo-cap

Anatomically accurate skinning

https://www.youtube.com/watch?v=E5rRcrRcoNo

iLarynx++: Intubation Simulator

https://www.youtube.com/watch?v=d62JdxyscNI

Computational Body Building

Start with Anatomy Transfer

https://www.youtube.com/watch?v=ddp996DIZOk

Skinning Mesh Animations

Approximate animation using skinning

- Used a lot in the industry
- Compression of pre-baked phys-based animations

Production-type projects

Topics: general recipe

Pick a paper (SIGGRAPH etc.)

- Variational integrators
- Cloth with self-collisions
- Rigid body simulation (will be covered in class)
- Finite element elasticity (will be covered in class)
- Control of articulated characters
- PIC and FLIP fluid simulation
- Level-set methods and water simulation
- Hair simulation
- Fire and explosions

Variational integrators

- Energy preservation
  - Conservative forces, no external forces -> kinetic + potential energy is constant
  - Implement integration method that preserves this exactly

Numerous papers from Caltech (e.g. [Kharevych et al. 06])

Cloth with self-collisions

- PBD or mass-spring
- Detect and respond to self-collisions

Seminal paper:

Robust Treatment of Collisions, Contact and Friction for Cloth Animation (Bridson, Fedkiw, Anderson, 2002)

Rigid body simulator

- Non-penetration constraints

Baraff & Witkin course notes (will be covered in class)

Control of articulated characters

- Use existing rigid body simulator

Seminal paper:

SIMBICON: Simple Biped Locomotion Control, Kangkang Yin, Kevin Loken, Michiel van de Panne SIGGRAPH 2007

PIC and FLIP fluid simulation

Hybrid particle/grid methods

- Used in industrial simulators

Animating Sand as a Fluid, Yongning Zhu, Robert Bridson, SIGGRAPH 2005

Level set methods and water

Practical Animation of Liquids, Nick Foster, Ronald Fedkiw, SIGGRAPH 2001

Hair simulation

A Mass Spring Model for Hair Simulation, Selle, Lentine, Fedkiw, 2008

Fire and Explosions

- “Physically Based Modeling and Animation of Fire” by Nguyen, Fedkiw, Jensen