

# **Physics-based Animation**

**Graduate School of Information Science and Technology 4860-1081**

# Plan

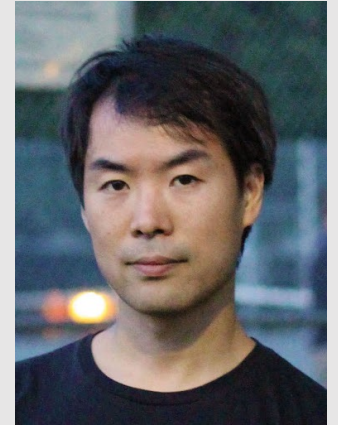
- Self-introduction
- Overview of physics-based animation
- Overview of this course
- Overview of assignments
- Slack
  
- Data structure

# **Self-Introduction**

# Short Bio

- Associate prof. at creative informatics department

Computer graphics, especially physics-based simulation, computational design...etc



- Graduated from U-Tokyo (BS/MS/PhD)
- Over 20 years of experience in physics-based simulation
- Research Scientist at
  - Autodesk Research (Canada)
  - Disney Research (Switzerland)

# Computation Design & Physics Simulation

- Interactive modeling of functional objects



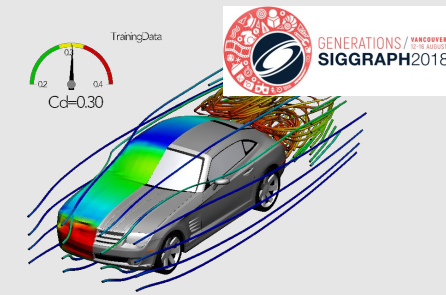
2010



2012



2016



2018



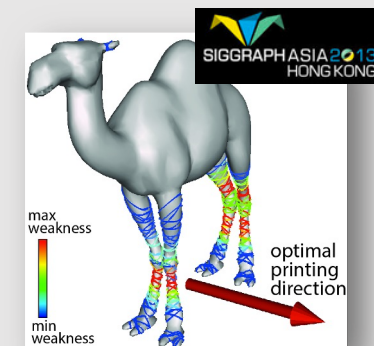
2015



2011



2014



2013

# Part of my Research

- Employed in simulator in MAYA [Umetani et al. 2014]



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Rod Simulations

# **Overview of Physics-based Animation**



# What are the Applications?

# Video Games



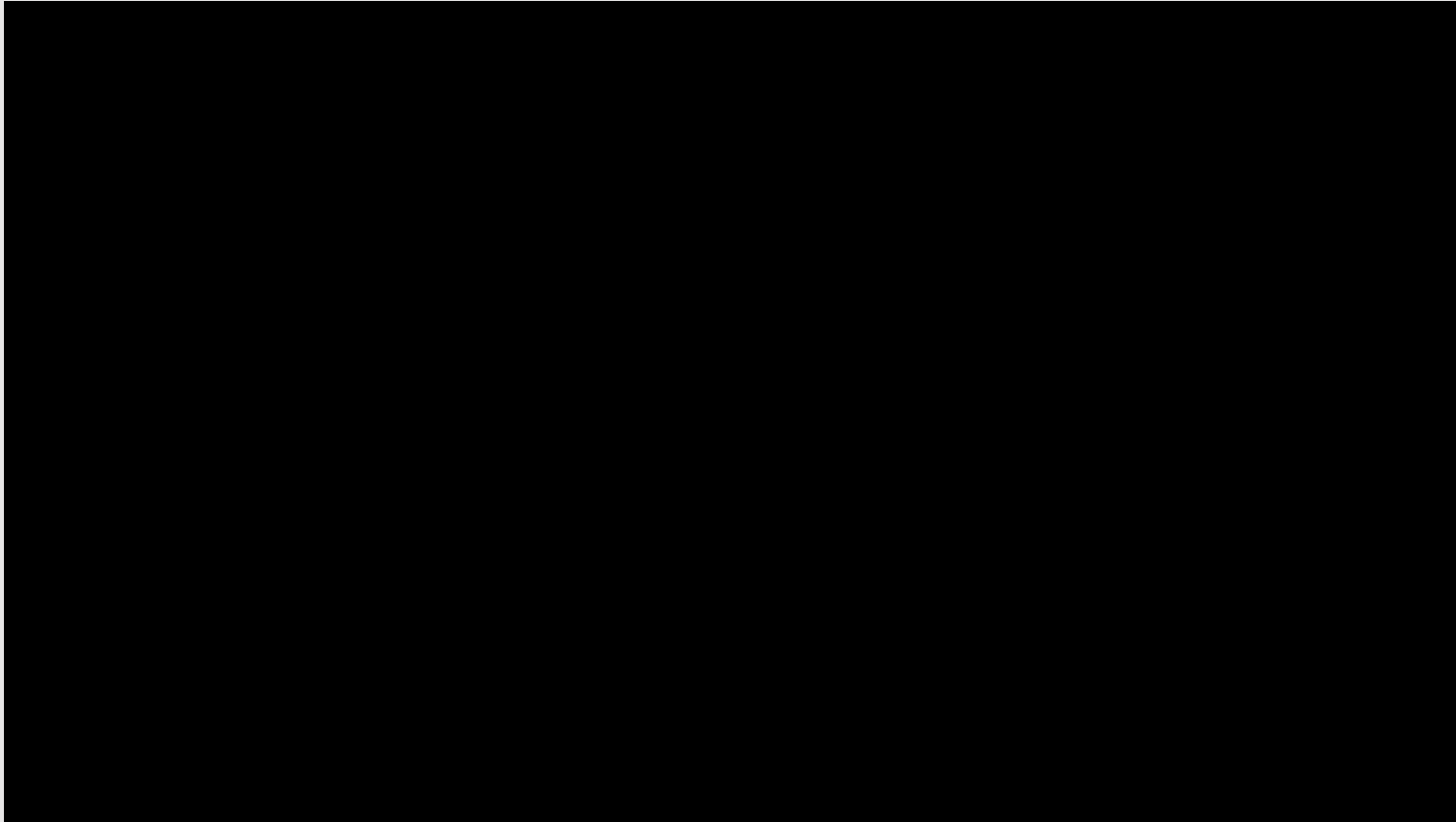
# Visual Effects / CG Animation



<https://www.vfxvoice.com/image-engine-and-the-art-of-the-vfx-breakdown/>

<https://www.youtube.com/watch?v=3M9Nwvysaul>

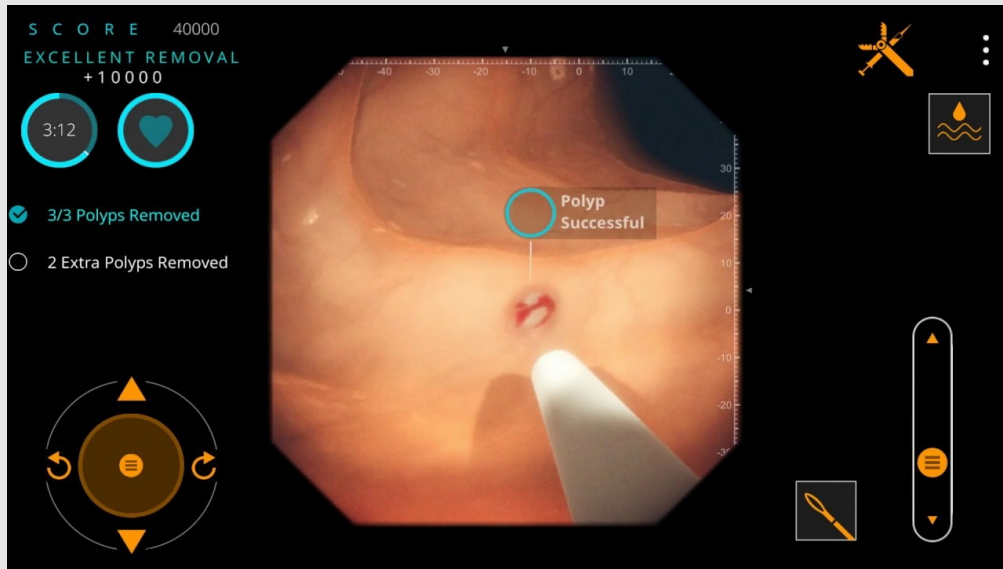
# Physics-based Animation Software



[Bifrost for Maya - Autodesk Area](#)



# Science, Training and Education



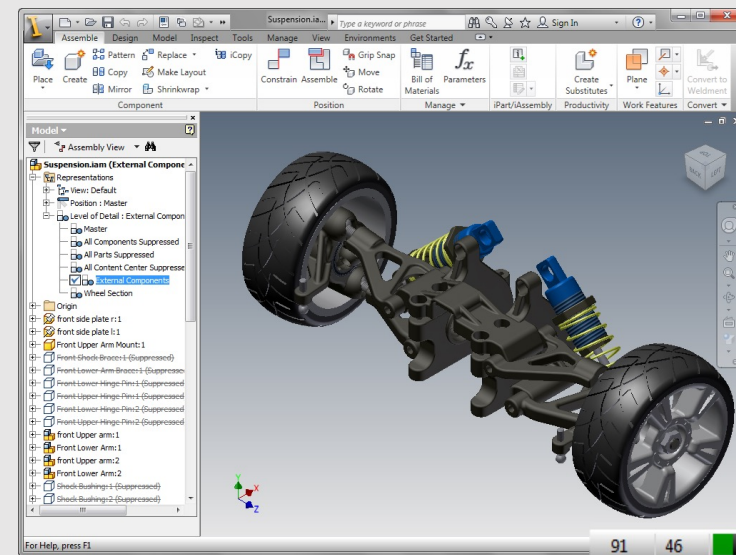
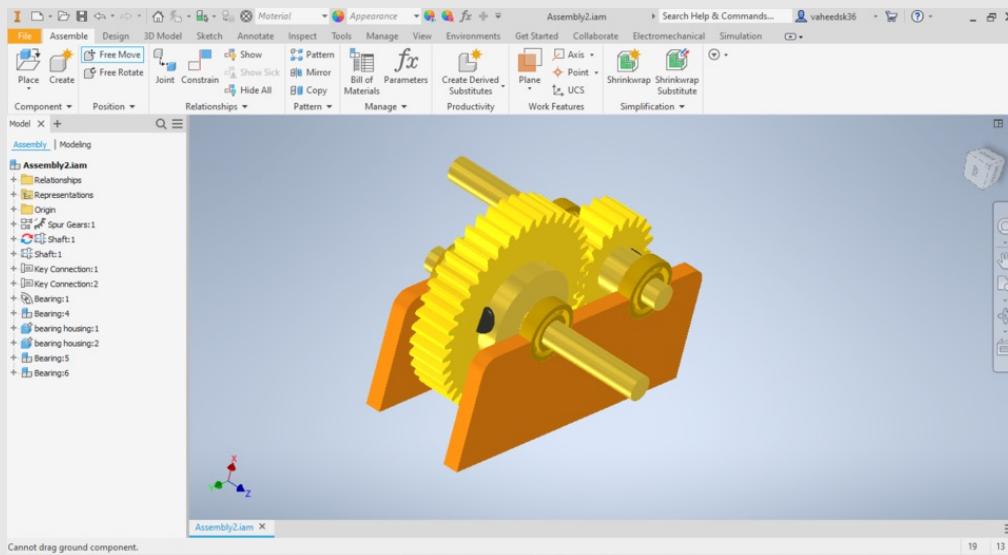
Gastro EX

<https://www.youtube.com/watch?v=kxwoVFpNKbQ>



Microsoft Flight Simulator 2020

# Computer-aided Design (CAD)



Autodesk Inventor

# Virtual YouTuber



<https://panora.tokyo/panora.tokyo/48622/HPC-index.html>



# E-Commerce



Personalized Avatars for Realtime Virtual Try-on (SIGGRAPH Asia 2019 Real-Time Live!)

<https://www.youtube.com/watch?v=OdPKf0oShr0>



# So Many Applications and Counting...

- Still in developing
  - new hardware
  - new algorithm
- There are still huge room for improvements
  - Until we achieve the world of “Matrix” movie



# Comparison with other Physics Simulation

## Physics-based Animation

☹️ Not trying to reproduce real-world quantitatively

😊 Simplicity (w.r.t. math & code)

😊 Interactivity

😊 Stability

😊 Visually pleasing result

😊 More complicated problem

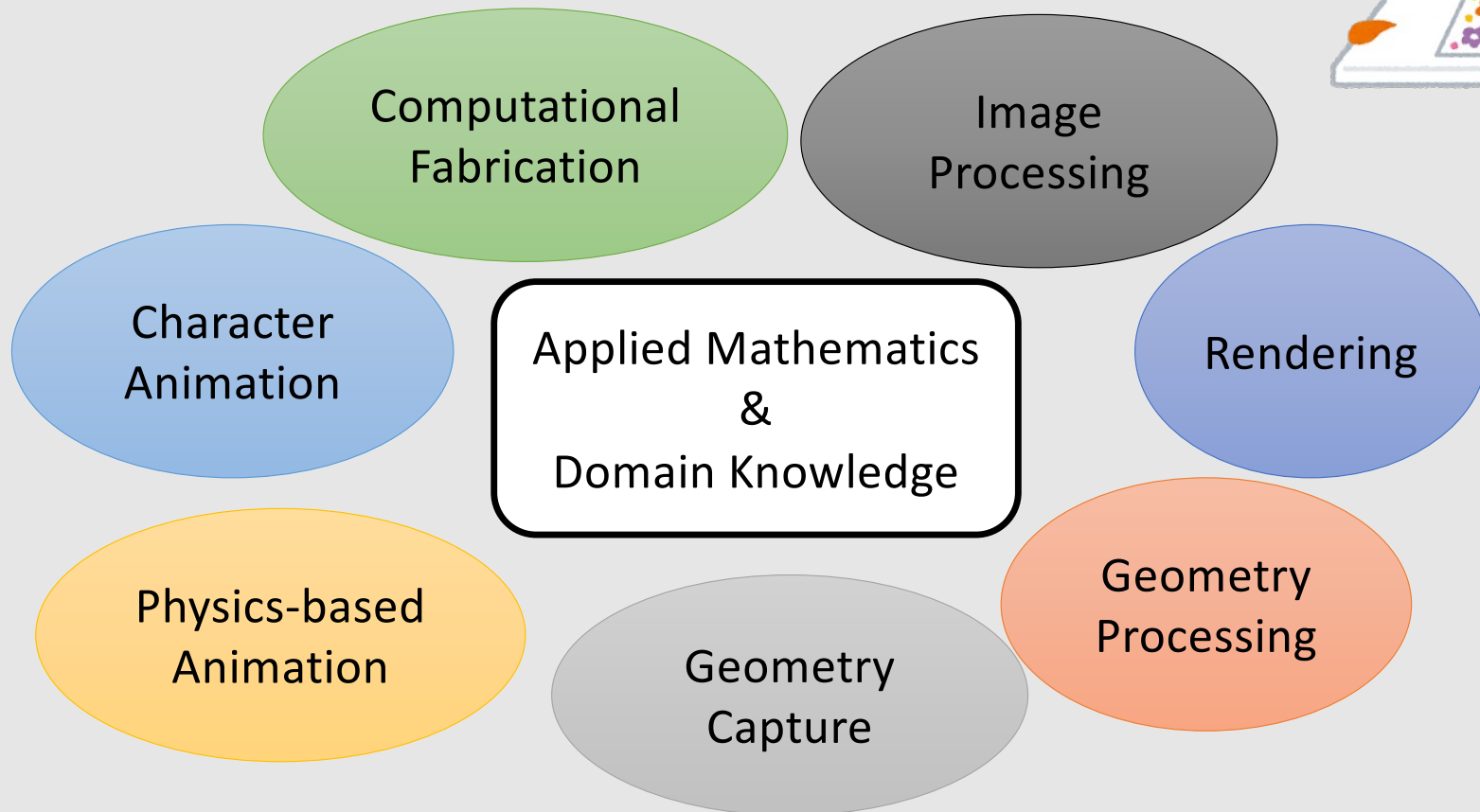
## Scientific / Engineering Sim.

😊 Trying to reproduce real-world data as much as possible



# Computer Graphics Research?

- New technologies to help artists



# **Overview of this Course**

# Our Goal: Math & Coding

- Getting familiar with applied mathematics
- Coding based on math equation
- Programming visual application is good for math & coding



# What You will Learn in This Course

- Review of applied math
  - Linear Algebra
  - (Multi-variable) Calculus
  - Partial Differential Equation (PDE)
  - Optimization
- Review of (classical) physics
- C/C++ programming
- Basic (legacy) OpenGL
- Git/GitHub

} useful for many other domains!



# What You will **NOT** Learn in This Course

- C++ hacks
- OpenGL hacks
- Software package
- Game design

# Grading

- 20% for course participation
  - Attendance is counted based on writing a secret keyword on LMS.
  - The keyword is announced for each lecture.
  - Starting from next lecture
- 80% for assignments
  - Small programming assignment submission by GitHub Classroom
  - Each assignment takes 1~2 hrs. to solve
  - Late submission -> point deduction
  - Scores and their weights are not determined until the end





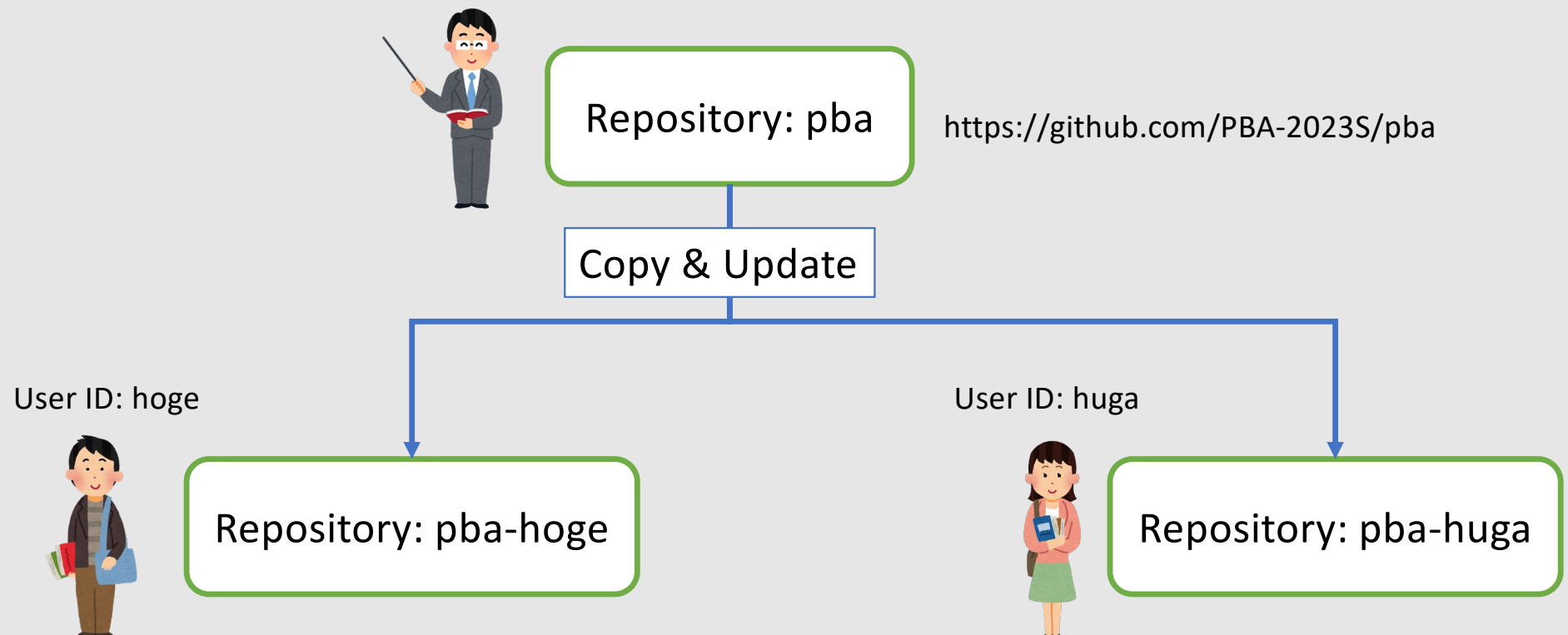
# Assignment Submission by Pull Request

- Why GitHub & Pull Request ?
  - Realistic software development scenario
  - More feedback!
- In the next class, I will explain how to set up GitHub repository
- Please create an account on GitHub (if you don't have one)

# What GitHub Classroom Do?



- Creating private repositories for all the students



# Sounds too Much Work?

