

# **Physics-based Animation**

# Plan

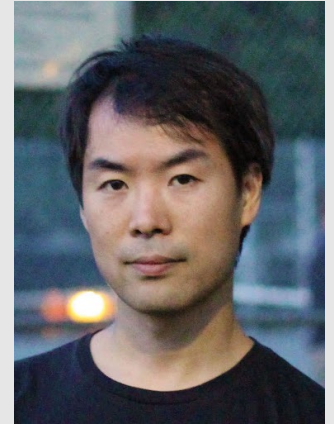
- Self-introduction
  - Overview of physics-based animation
  - Overview of this course
  - Overview of assignments
- 
- Data structure
  - Interpolation

# **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 19 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



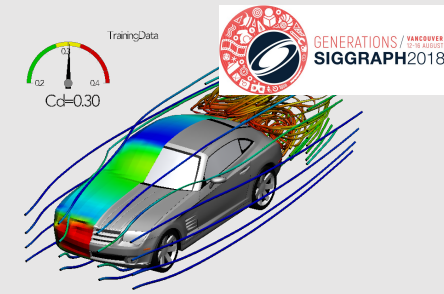
2010



2012



2016



2018



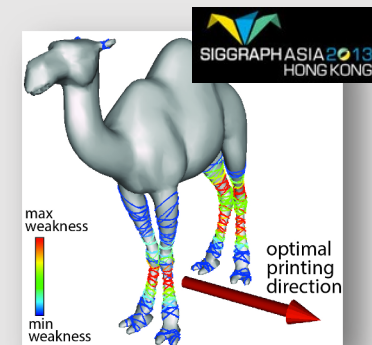
2015



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



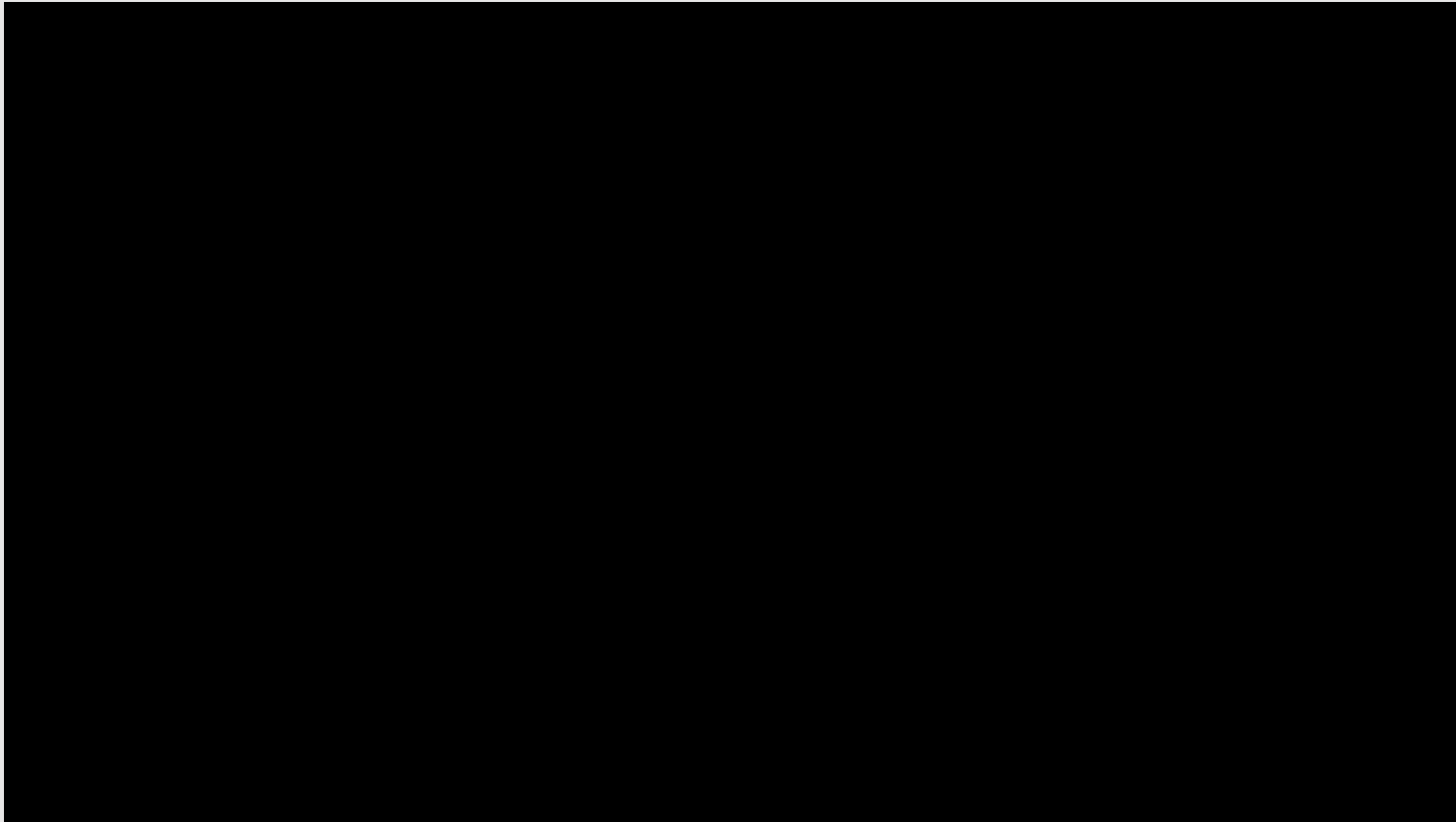
# Visual Effects / CG Animation



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

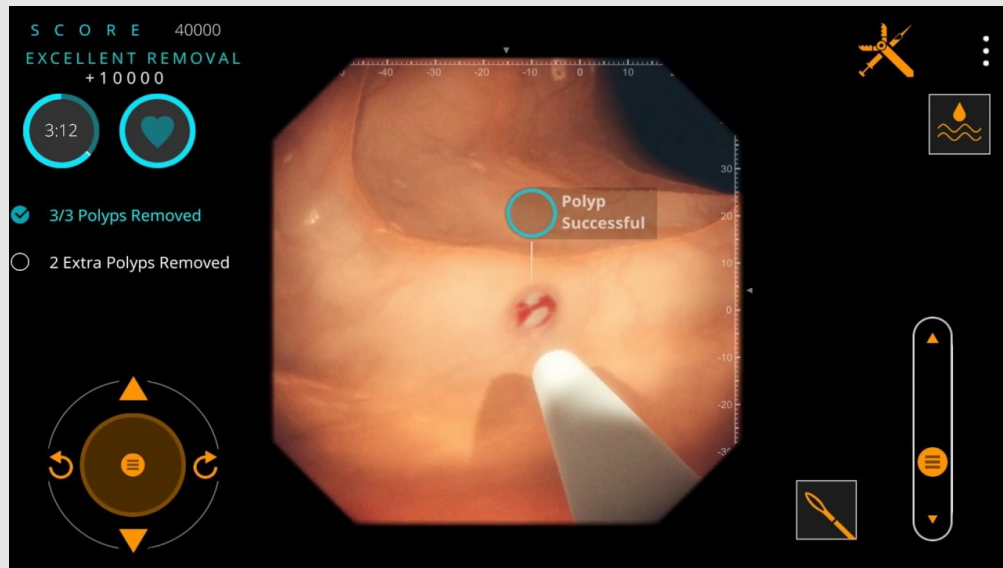
<https://www.youtube.com/watch?v=3M9Nwvysaul>

# Physics-based Animation Software



[Bifrost for Maya - Autodesk Area](#)

# Science, Training and Education



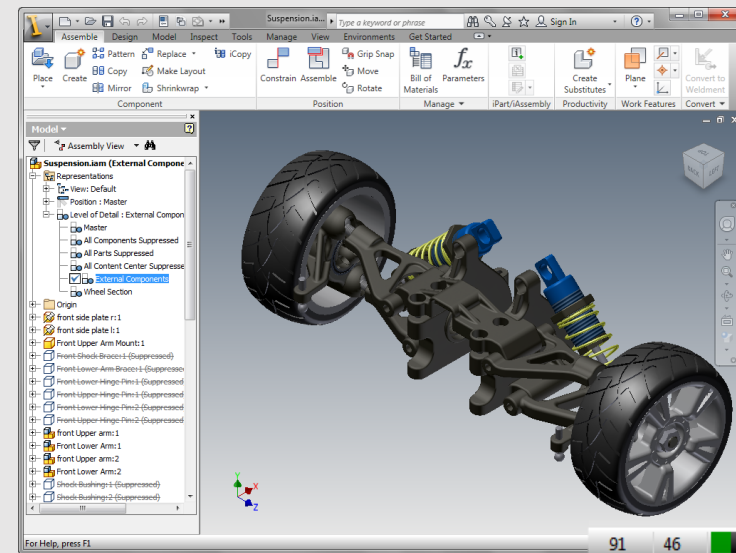
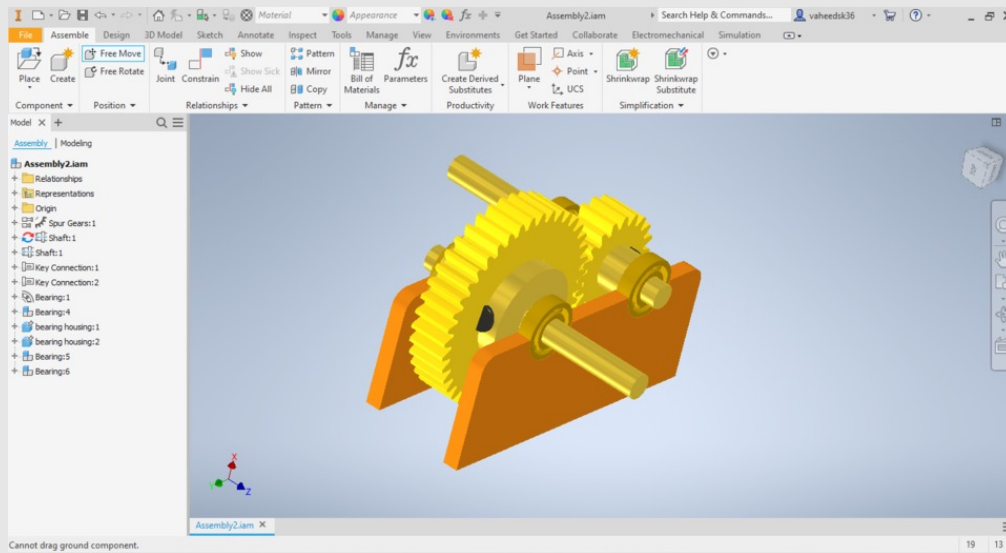
Gastro EX

<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>

# Comparison with other Physics Simulation

## Physics-based Animation

☹️ Not trying to much real-world

😊 Simplicity (w.r.t. math & code)

😊 Interactivity

😊 Stability

😊 Visually pleasing result

😊 More complicated problem

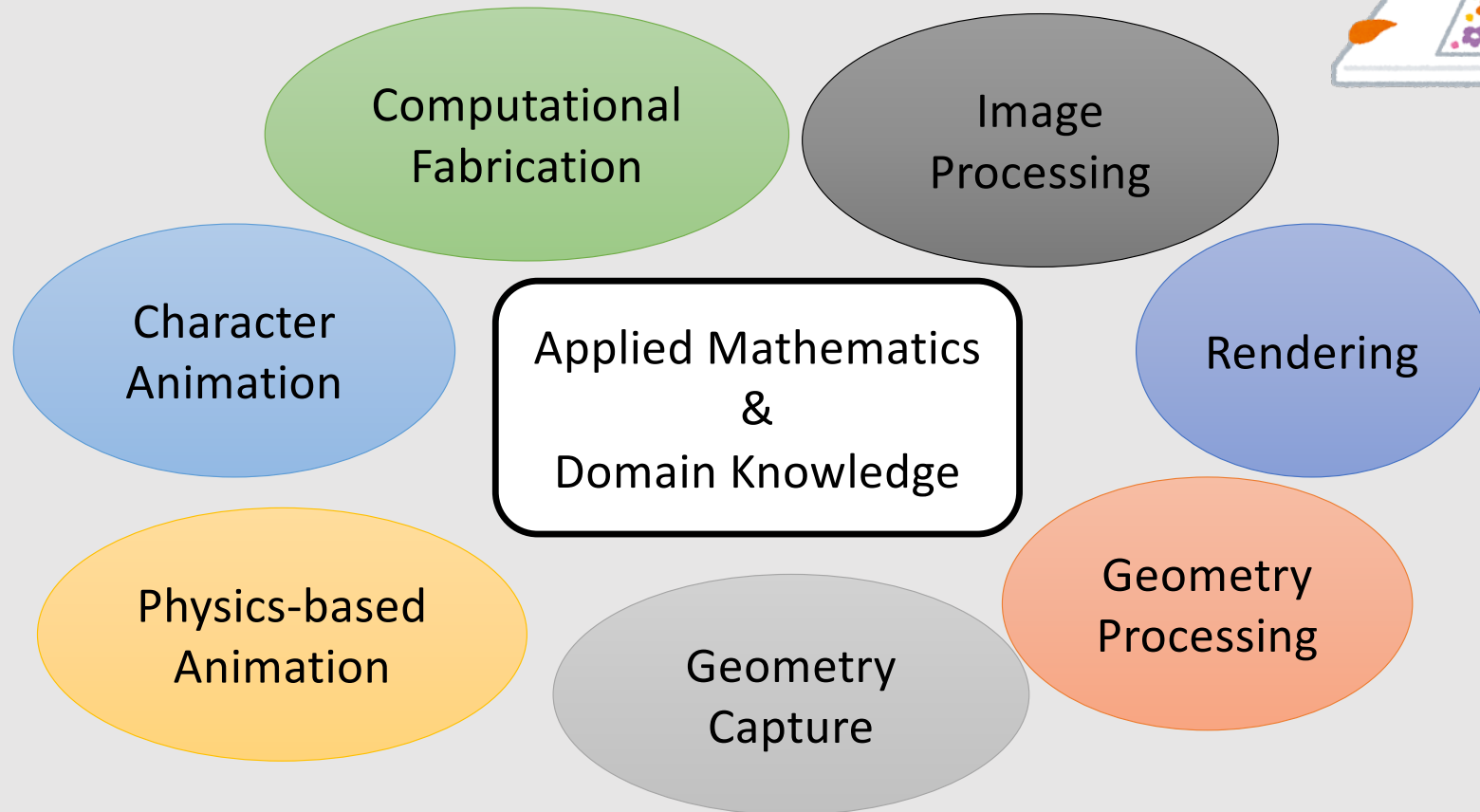
## Scientific / Engineering Sim.

😊 Trying to much real-world



# 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
  - Counted by asking question in the lecture
  - Maximum 1 count for 1 lecture, 5 counts in total
  - Starting from next lecture
  - Tell me your student ID & name when asking questions



- 80% for assignments
  - Small programming assignment submission by GitHub Classroom
  - 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)