430.217 (001)
자료구조의 기초
2016년 2학기

고형석 교수

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Lecture 1
Introduction

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Text Book

- 주교재
  - E. Horowitz, et al, Fundamentals of data structures in C++
- 부교재
  - Mark Allen Weiss, Data Structures & Algorithm Analysis in C++, Addison Wesley

Lecturer and TAs

- **Lecturer**
  - Prof. Hyeong-Seok Ko
  - Office: 133-502
  - E.Mail: ko@graphics.snu.ac.kr
  - Home page: http://graphics.snu.ac.kr/~ko
- **TAs**
  - TA: 한동훈 dhhan@graphics.snu.ac.kr 133-211

Grading

- **Homeworks: 40%**
- **Midterm: 30%**
- **Final: 30%**
- **Class Participation**
  - 출석은 random하게 체크하며 한번의 결석마다 한 단계의 학점 강등이 이루어 짐

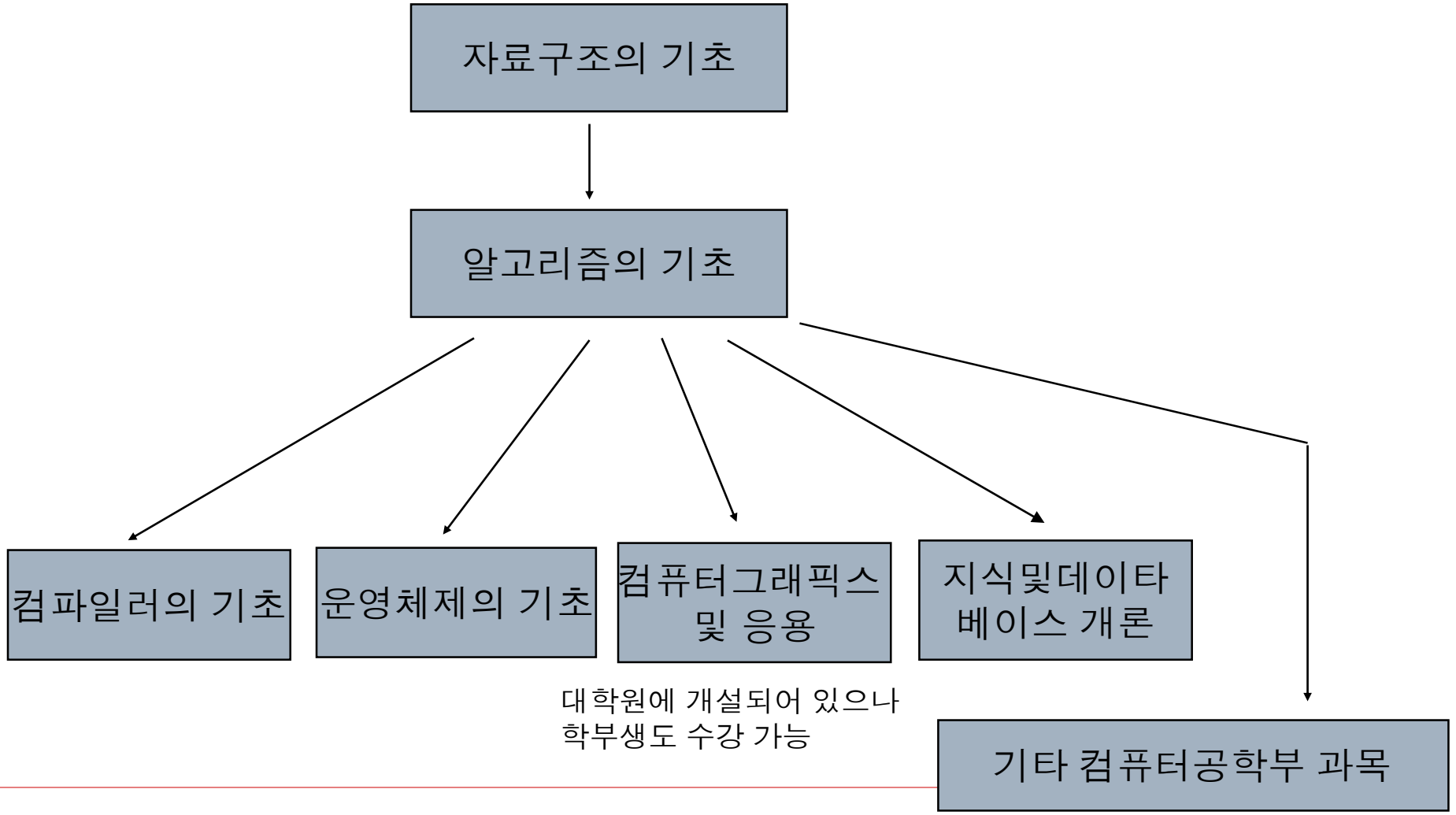
Additional Information

- **Prerequisites**
  - 컴퓨터의 기초, 프로그래밍 방법론
- **Programming Languages for Programming Assignments**
  - C++
- **How to Succeed in this course:**
  - Read the book
  - Practice solving many problems in the book (About 30% of exams will be from the problems in the book)

Acknowledgement

이 강의 슬라이드는 심규석, 차상균,
백윤흥교수님께서 사용 하셨던 슬라이드를
바탕으로 제작되었습니다.

SoEE Core SW Curriculum



Program = Data Structure + Algorithm

- **Real World Problem versus Formalized Problem**

Finding an optimal route	*Finding the minimum-cost path*
from SNU to the Olympic Stadium	*from origin node to destination*
	on a weighted network

- 자료구조의 기초 **teaches**
  - How to formalize ***problems*** (e.g., with trees and networks)
  - How to implement solutions with ***data structures*** *(and algorithms)*
  - How to evaluate the ***quality of implemented solutions*** (running time or space requirement)

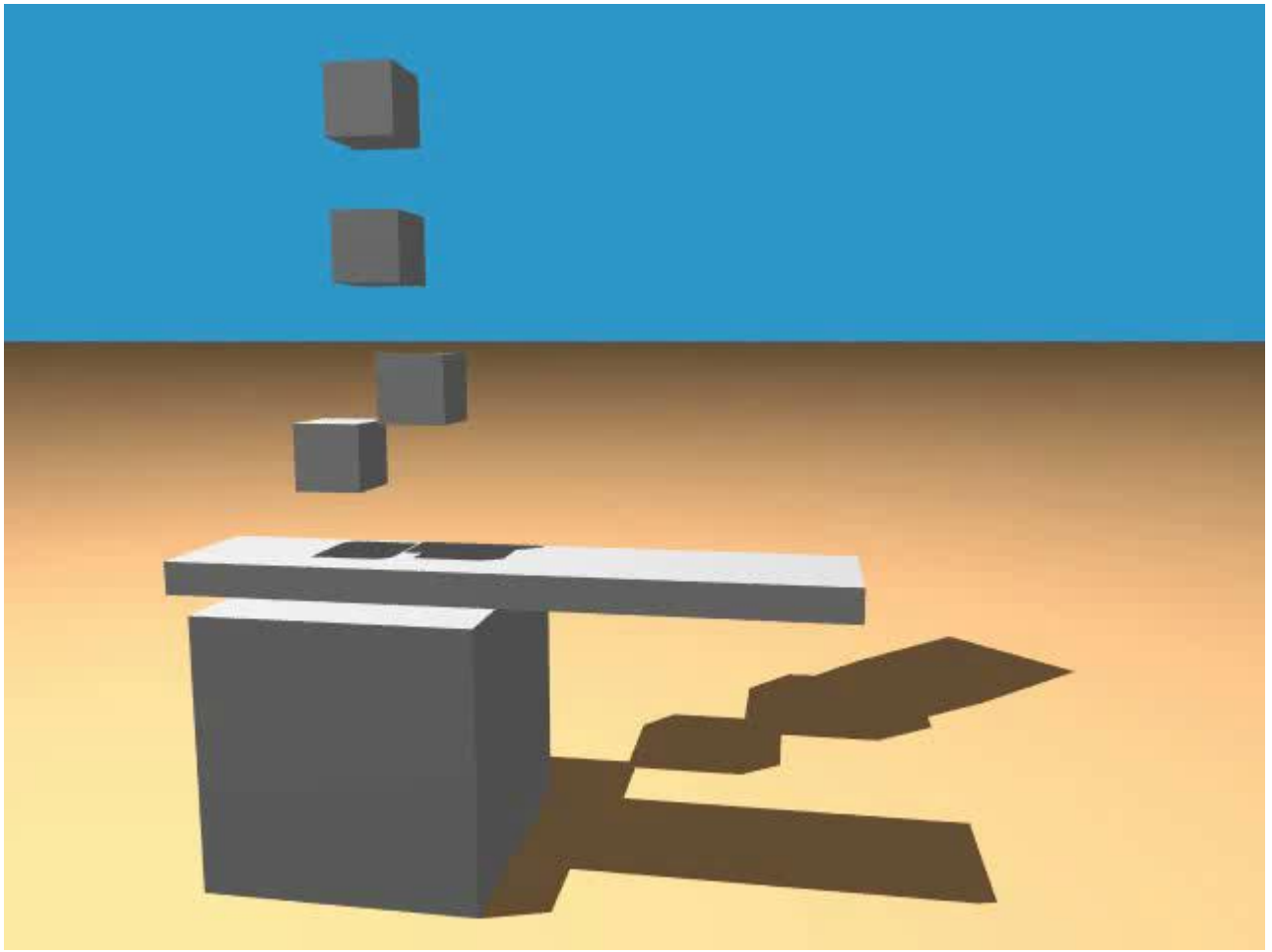
자료구조의 중요성

You cannot build any nontrivial system without computers, and you cannot build any computer application without good knowledge of data structures.

The following are a list of some nontrivial computer applications:

- Computer Graphics
- Telecommunication Systems
- Control Systems (Power Plant Control, Missile Guidance, etc.)
- Internet Applications such as Electronic Commerce (B2C, B2B, …)
- Computer-Aided Engineering and Manufacturing

자료구조의 사용: 그래픽 물리공간



$$m_i$$

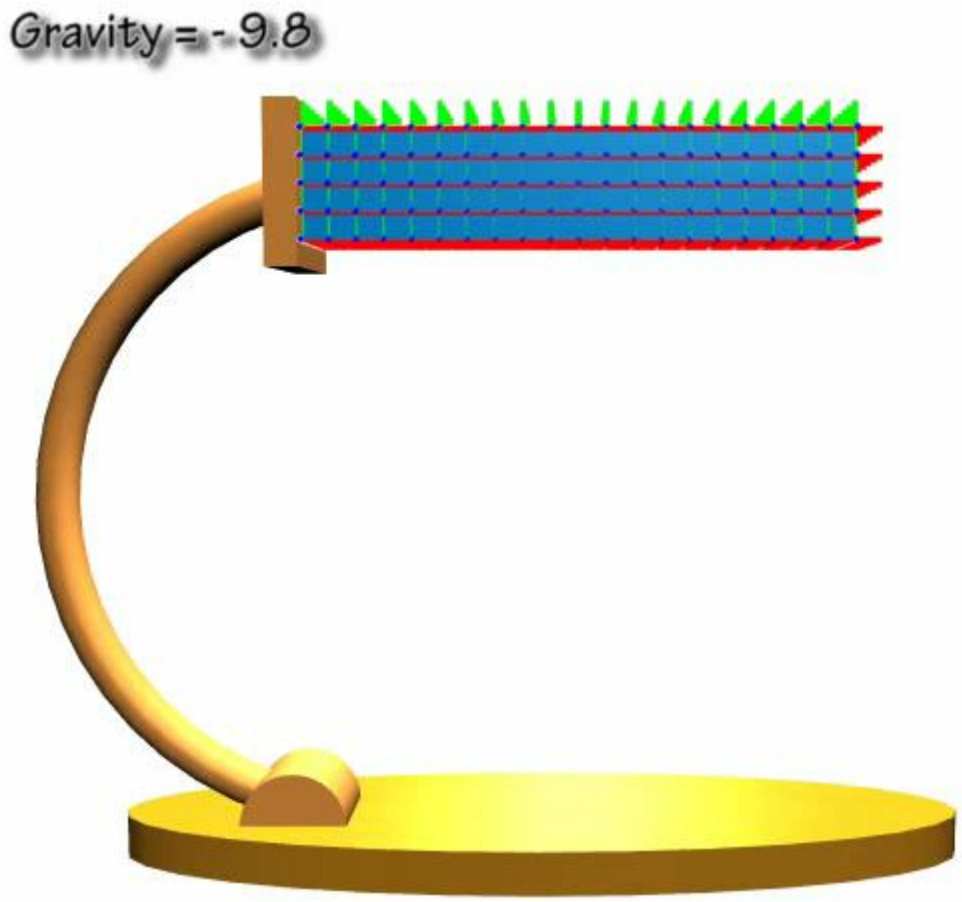
$$COM_i$$

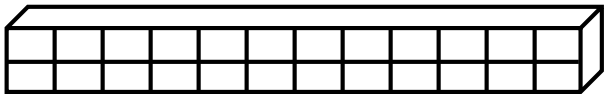
$$\begin{bmatrix} x_i & v_i & a_i \end{bmatrix}$$

$$I_i$$

$$\begin{bmatrix} q_i & \dot{q}_i & \ddot{q}_i \end{bmatrix}$$

자료구조의 사용 : **Deformation**

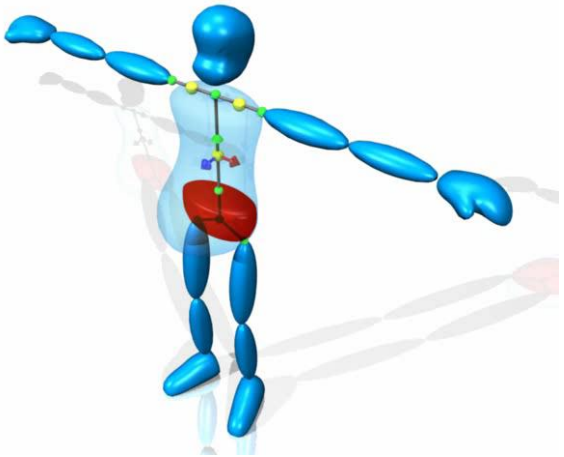


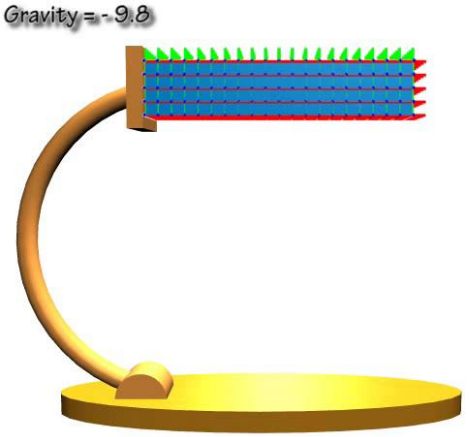


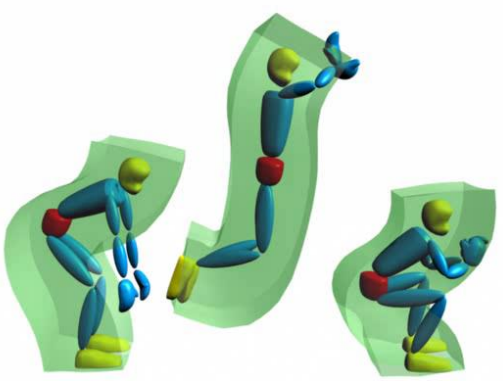
Application of the technique

Modal Warping

“Method and System of Real-Time Graphical Simulation of Large Rotational Deformation and Manipulation Using Model Warping ”







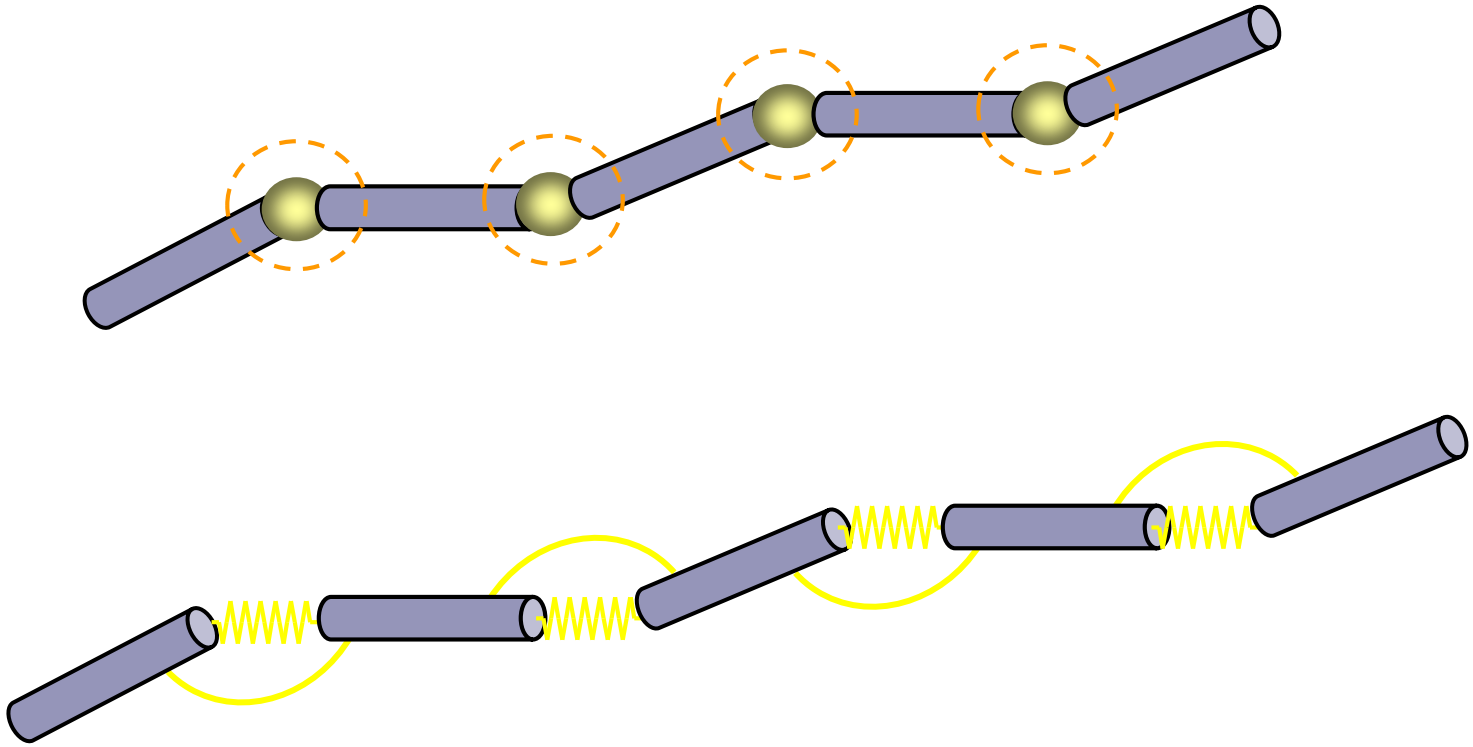
자료구조의 사용 : Modeling Hair

- **“A Statistical Wisp Model and Pseudophysical Approaches for Interactive Hairstyle Generation”, IEEE Transactions on Visualization and Computer Graphics 2005**
- **“Simulating Complex Hair with Robust Collision Handling”, Symposium on Computer Animation 2005**

헤어 모델링

헤어 애니메이션

Data Structures Used

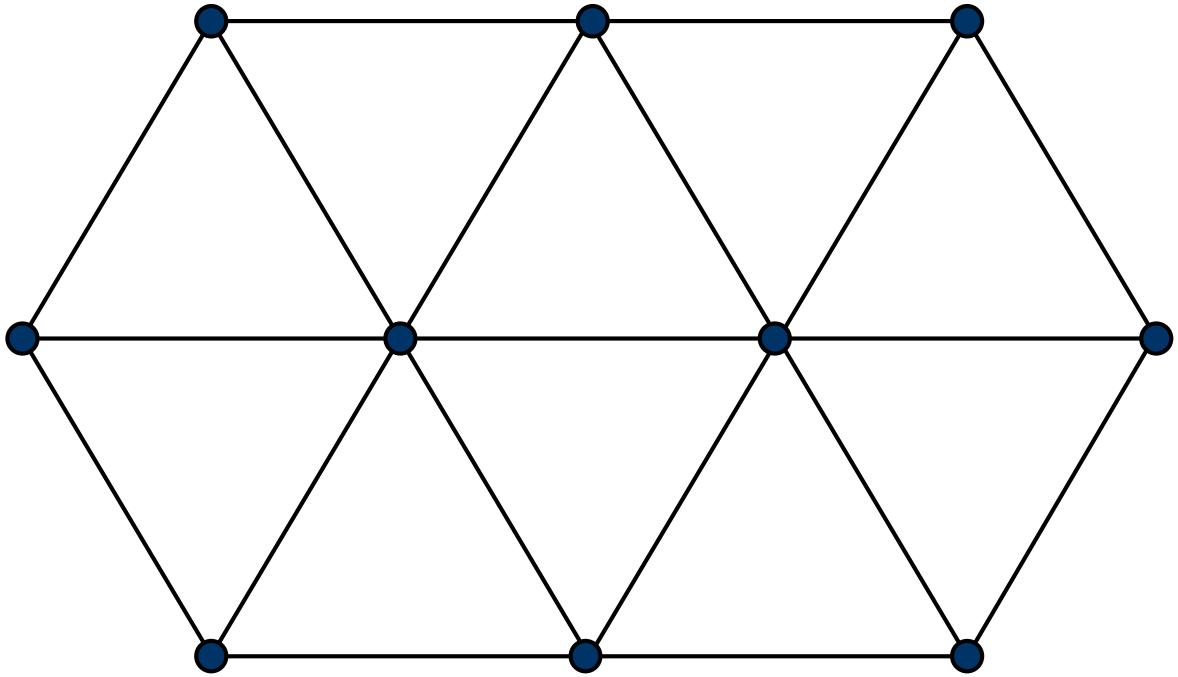


자료구조의 사용 : Modeling Clothing

- “Stable but Responsive Cloth”, SIGGRAPH 2002 (ACM TOG).
- “Constrainable Multigrid for Cloth”, Computer Graphics Forum 2013, 32(7)

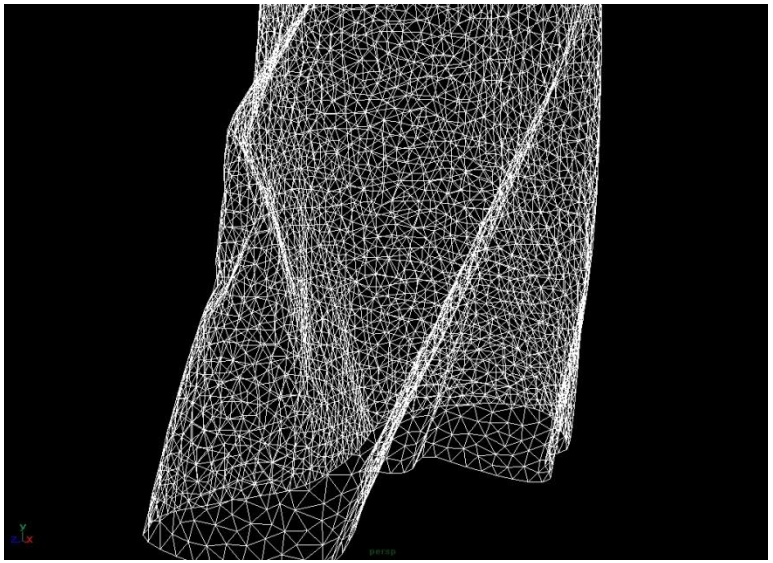
First of All, How to Represent Cloth?

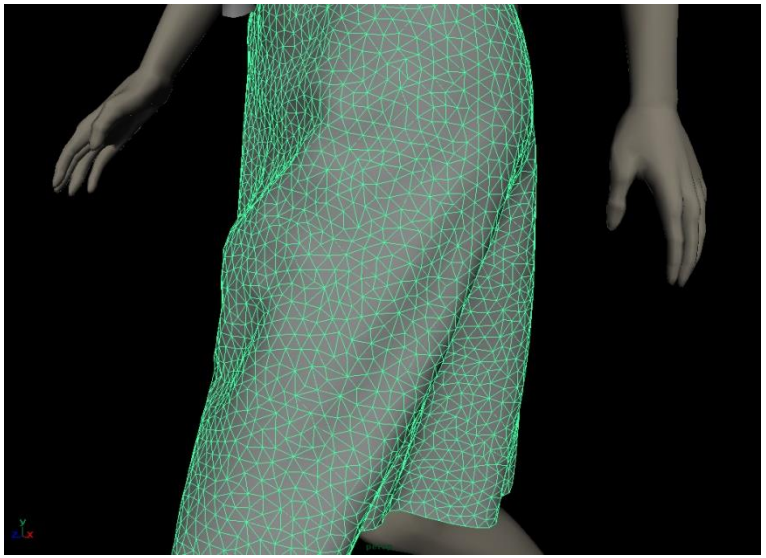
Particles interconnected by springs



Particle-based Cloth Simulation

- **Repeat the following:**
  1. Find the new position of the particles
  2. Draw the surface from the particles





Is that a still challenge?

시뮬레이션 속도 = 10spf

실시간 시뮬레이션이 요구됨

가까이에서 봐도 직조 구조가 안보임

직조 구조의 가시화가 요구됨

- 시간적분
- $\ddot{\boldsymbol{x}} = \boldsymbol{M}^{-1}\left(-\frac{\partial E}{\partial \boldsymbol{x}} + \boldsymbol{F}\right)$
- $\left(\mathbf{M} - \Delta t \frac{\partial \mathbf{f}}{\partial \mathbf{v}} - \Delta t^2 \frac{\partial \mathbf{f}}{\partial \mathbf{x}}\right)\Delta \mathbf{v} = \Delta t\left(\mathbf{f}_0 + \Delta t \frac{\partial \mathbf{f}}{\partial \mathbf{x}}\mathbf{v}_0\right)$
- $Ax = b$
- 한복의 경우 21만×21만의 선형시스템을 풀어야 함

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