ANIMATION, SIMULATION, COLOR, AND IMAGING 11

CS184: COMPUTER GRAPHICS AND IMAGING

April 16, 2019

1 Animation and Physical Simulation

1. What are keyframes and what do we do with them?

2. What is the difference between forward and inverse kinematics? What are some problems associated with the latter?

3. Recall the forward, or explicit Euler method, which uses the following update rules:

$$\boldsymbol{x}^{t+\Delta t} = \boldsymbol{x}^t + \Delta t \dot{\boldsymbol{x}}^t$$
$$\dot{\boldsymbol{x}}^{t+\Delta t} = \dot{\boldsymbol{x}}^t + \Delta t \ddot{\boldsymbol{x}}^t$$

where $\boldsymbol{x}^t, \dot{\boldsymbol{x}}^t, \ddot{\boldsymbol{x}}^t$ respectively denote the position, velocity, and acceleration at time t.

(a) Give some pros and cons of using the explicit Euler method.

(b) Say we have a particle with mass 1 starting at position $\boldsymbol{x}^0 = (0, 1)$ with an initial velocity $\dot{\boldsymbol{x}}^0 = (-1, 0)$ and no initial acceleration. The particle is at one end of a spring, whose other end is the origin $(0, 0)$, and whose spring constant is $k = 1$ and rest length is 1. Calculate particle's position at $t = 3$ using the explicit Euler method with timestep $\Delta t = 1$.

2 Sensors

1. What is ISO, or gain, and how is it related to exposure?

2. What is signal-to-noise ratio (SNR), and how is it mathematically defined?

3. If we assume that photons arrive on the image sensor according to a Poisson distribution, then SNR scales with the square root of the number of photons. This means that as I acquire more photons, the overall noise in my image will decrease (which should match our intuition). If I want increase my SNR by a factor of 2, how should I change the size of my aperture?

3 Colors

1. What is a metamer? Why are metamers useful?

2. What are some common problems associated with defining a color space?

3. What is the purpose of the CIE chromaticity diagram and how is it read? Why is black not on this diagram?

4. What is the goal of the CIELAB color space?