

Simulating Motion and Spatial Data Structures

1. Numerical Integration

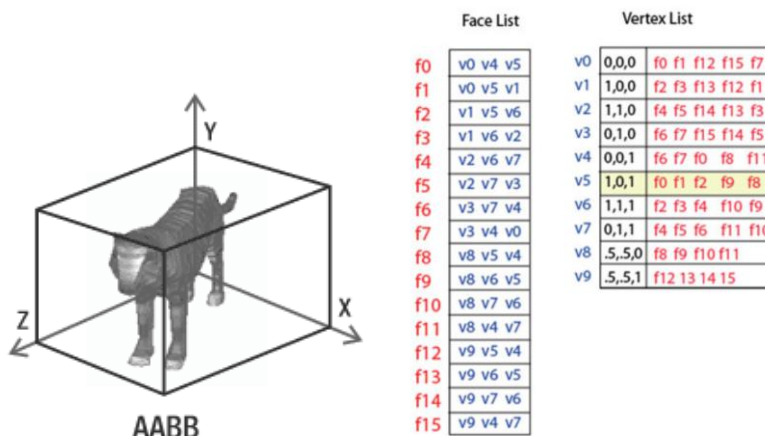
Given a function for acceleration and an initial position and velocity, at a time $t=0$ we can approximate the function for position with respect to time by using Euler integration:

$$p(t + \Delta t) = p(t) + \dot{p}(t)\Delta t \quad \text{and} \quad \dot{p}(t + \Delta t) = \dot{p}(t) + \ddot{p}(t)\Delta t$$

What are two factors that influence the amount of error in our approximation?

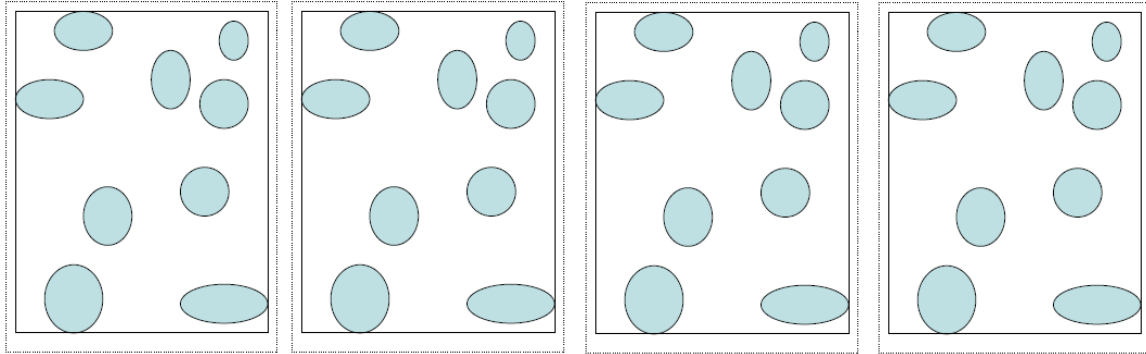
2. Axis-Aligned Bounding Box

Suppose we have a geometric model expressed as a triangle mesh in an indexed-face format. Describe an efficient way to compute an AABB that encloses the mesh.



3. Bounding Volume Hierarchy

- a. Draw 4 levels of a bounding volume hierarchy for the following objects below, splitting (approximately) either on the median centroid or the average centroid. Split on the longest axis.



- b. Is it possible for two nodes in a BVH to intersect? If not, why not? If so, draw such a situation and describe in what way this will affect a collision detection system.