

POINT MASS AS GAME OBJECTS IN A 2D PHYSICS SIMULATION

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ABSTRACT

This paper gives an overview of how point mass can be used in a physics engine to simulate a game object that can be combined with a collider of any shape to enable collision with other game objects in a virtual environment in a physically plausible manner. The Point Mass is purely based on Newton's Laws of Motion which describes the relationship between motion of our point mass object and the forces acting on it. By using point mass concept, we can create a simple physics engine that works for almost any game that does not require rotational behaviour.

Keywords: Point Mass, Collider, Physics Engine, Game Objects, Virtual Environment, Simulate

1. INTRODUCTION

Physics Engines are prominent games system in the Video Games Industry, as they allow us to experience real-world simulations and physics that are used in some of the modern game titles such as Half-Life: Alyx, GTA V, Red Dead Redemption 2, Crysis Remastered, Doom Eternal, as they use complex rigid body mechanics to simulate physics.

In this paper we are going to look at a part of the physics engine that is responsible for the simulation of our game objects. You can think of game objects as a player, an AI enemy, a tree, a bullet, or an arrow. Now we can implement a game object as a Point Mass, which has position and some mass, but no size or any geometric shape that it can take, and it have some kinematic properties such as velocity and acceleration which are integrated over time by our physics engine to find out the position of our game object in our 2D world.

2. LITERATURE SURVEY

[1] "Game Developer Magazine on Rigid Body Dynamics" by Chris Hecker. This is a series of articles that describes the mathematics behind rigid body dynamics, Collision Detection and Response system that can also be used for point masses.

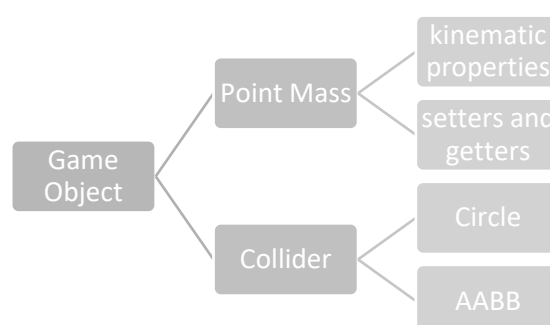
[2] "Simulating Physics with Computers" by Richard Feynman, International Journal of Theoretical Physics, 1982. This paper highlights the potential of computer simulation as a powerful tool for studying and understanding the newton's laws of physics.

3. PROPOSED SYSTEM

The Point Mass concept can be implemented as a class along with its properties such as mass, position, velocity, and acceleration and you can initialize and access them through a set of setters and getters respectively. Since we will know the value of acceleration in most cases, we can integrate it with respect to delta time to get its velocity and integrating velocity with respect to delta time tells us the position of our point mass or our game object. This is done by numerical integration methods such as Euler Integration, Verlet Integration, or RK4 method and so on.

Now we have some motion, we need a way for these game objects to detect if it is touching other game objects and to resolve them such that they stop intersecting or penetrating each other. Since our point mass class does not define a geometric shape, we can extend our class to have a collider that can take any basic primitive shape such as circle or an axis aligned bounding box.

4. CLASS ARCHITECTURE



5. CONCLUSION

The system discussed in this paper enables you to create a simple physics engine that does not require complex mathematics that is involved in rigid body dynamics, since they are capable of simulating rotational dynamics. The point mass concept can be used to simulate almost any type of game objects in games and the concept can be extended to rigid body physics as the engine evolves.

6. REFERENCES

- [1] “Game Physics Engine Development” Book by Ian Millington, 2010.
- [2] “Real-Time Collision Detection” Book by Christer Ericson, 2005.
- [3] “Custom Math Libraries” Conference Talk by Sean Middleditch, 2012.