

Using numerical methods to simulate Newtonian mechanics in video games

An exploration into the physics of video games by implementing numerical methods through programming. There are several methods to consider when developing a physical system for a game, for instance Euler's method is an efficient method, which unfortunately is rarely viable. There also exist a few variations to Euler's method that give more functionality, such as semi-implicit Euler and implicit Euler. Each has different restrictions and advantages, but that not to say we only explore Euler's and its variations. Verlet integration is a useful method to calculate trajectories in a multiple particle system, which been utilized across many fields. Lastly we will study RK4, Runge-Kutta 4, a method developed by two German mathematicians. RK4 is by no means a perfect numerical method, but is a good general purpose integration technique. We investigate single-particle systems in two dimensions, and note the similarity to multi-particle systems in two dimensions. Adding a third dimension greatly increases the complexity of the simulation , we simply touch on the topic for today. A less formal discussion of a few important considerations in game development takes place, topics include varying refresh rates and PC specifications (the game should run the same for everyone, every time it is executed), and how communicating with a server introduces much more complexity.