Explicit Euler

Initial Conditions:

P_0 - initial position

V_0 - initial veclocity

Global Conditions:

Δt - time step

$A = F(t, P, V)$ - acceleration as a function of time, position, and velocity

For each iteration:

$V_i = V_{i-1} + \Delta t * A_i$ - velocity = previous velocity + time step * current acceleration

$P_i = P_{i-1} + \Delta t * V_i$ - position = previous position + time step * current velocity

Verlet

Initial Conditions:

P_0 - initial position

V_0 - initial veclocity

Global Conditions:

Δt - time step

$A = F(t, P)$ - acceleration as a function of time and position

First Iteration:

$P_1 = P_o + \Delta t * V_0$ - position = previous position + time step * current velocity

For each iteration:

$P_i = 2*P_{i-1} - P_{i-2} + \Delta t * \Delta t * A_i$ - position = 2*previous position - doubly previous position + time step * time step * acceleration

Velocity Verlet

Initial Conditions:

- P_0 - initial position
- V_0 - initial veclocity

Global Conditions:

- Δt - time step
- $A = F(t, V, P)$ - acceleration as a function of time, velocity, position

For each iteration:

$P_i = P_{i-1} + \Delta t * V_{i-1} + 0.5 * \Delta t * \Delta t * A_i$ - position = 2*previous position + time step * velocity + 0.5 * time step * time step * acceleration

$V_i = V_{i-1} + 0.5 * (A_i + A_{i+1}) / \Delta t$ - velocity = previous velocity + 0.5*(acceleration + next acceleration)/time step