Assignment 1

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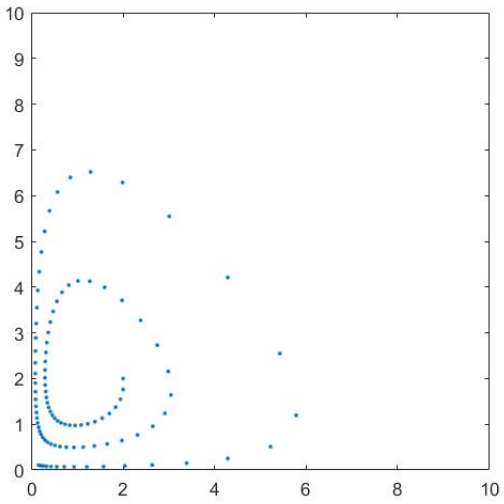
1 Problem 1

1.1 Forward Euler

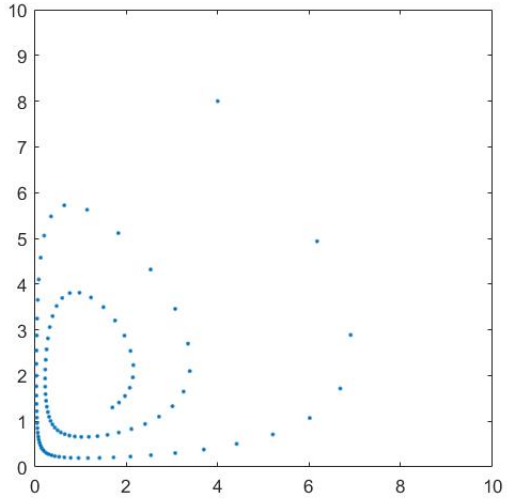
We choose a time step of 0.12 and set the total number of steps to be 100, with an initial guess of $(2, 2)$. The result is shown below.



Ffigwr 1: Forward with initial guess at $(2, 2)$

1.2 Backward Euler

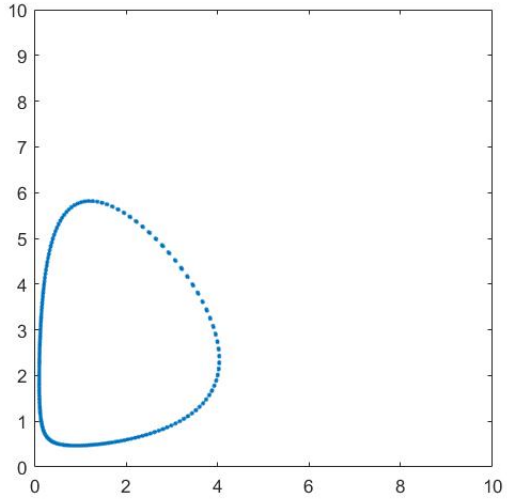
We choose a time step of 0.12 and set the total number of steps to be 100, with an initial guess of $(4, 8)$. The result is shown below.



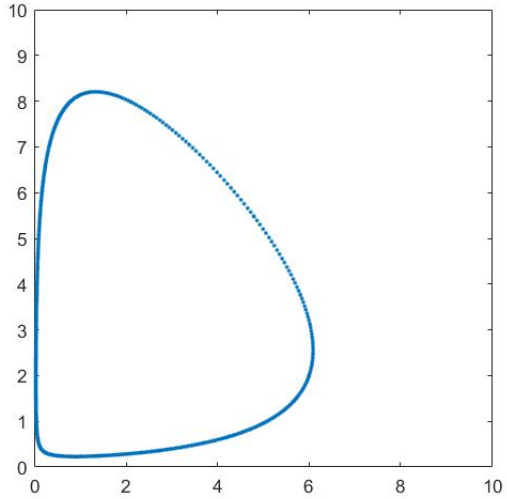
Ffigwr 2: Backward with initial guess at $(4, 8)$

1.3 Symplectic Euler

We choose a time step of 0.12 and set the total number of steps to be 100, with an initial guess of $(4, 2)$ and $(6, 2)$ repectively. The result is shown below.



Ffigwr 3: Symplectic with initial guess at $(4, 2)$



Ffigwr 4: Symplectic with initial guess at $(6, 2)$

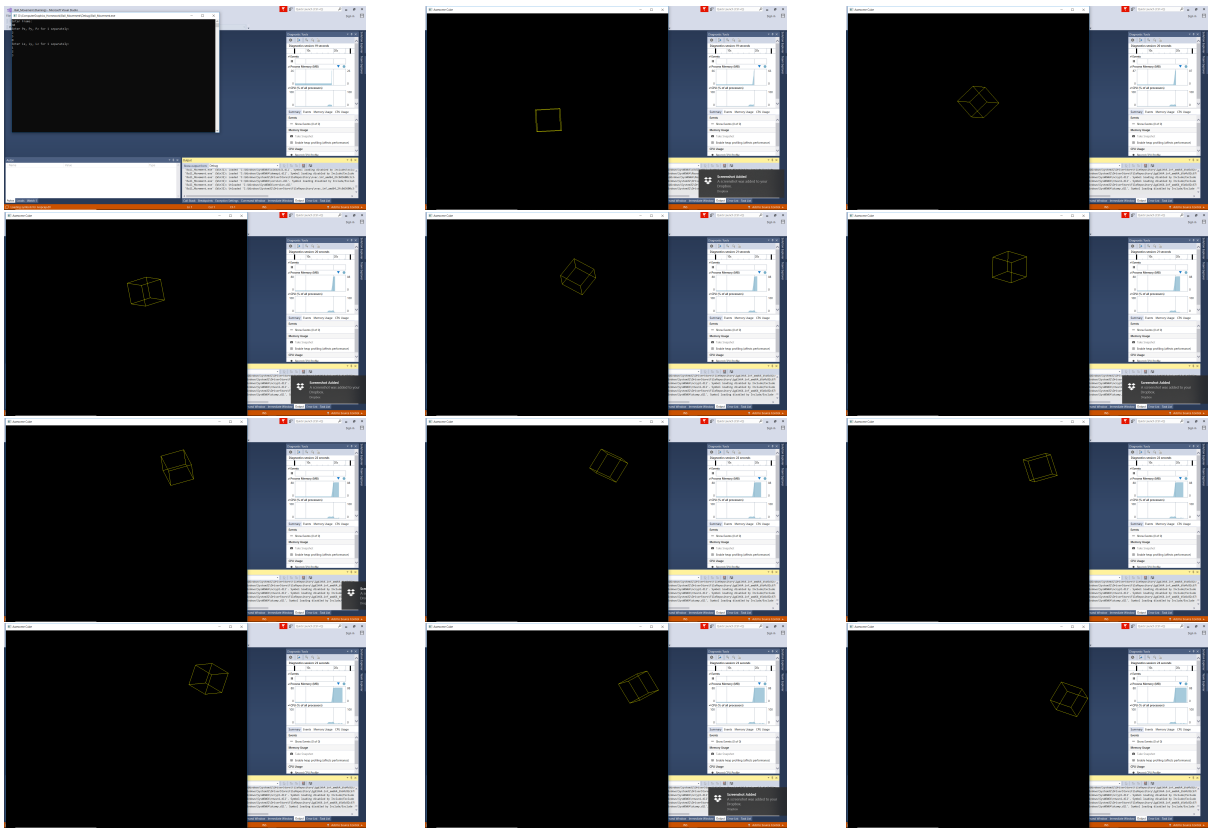
2 Rigid Body Simulation

2.1 Structure

Class RigidBody: it contains data which can depict a rigid body and some methods to set and get those data.
Class Sol: it provides all the methods we need to initialize a rigid body, to take a time step and update all the data.
main: it sets up the simulation system(frame, L, P, etc.)

2.2 Simulation Result

As shown below.



Ffigwr 5: Simulation result

3 Problems

If I don't normalize the rotation matrix, the shape of the cube will change and it is no longer a rigid body which means the simulation fails.