ISF 311 Computer Graphics Assignment 1

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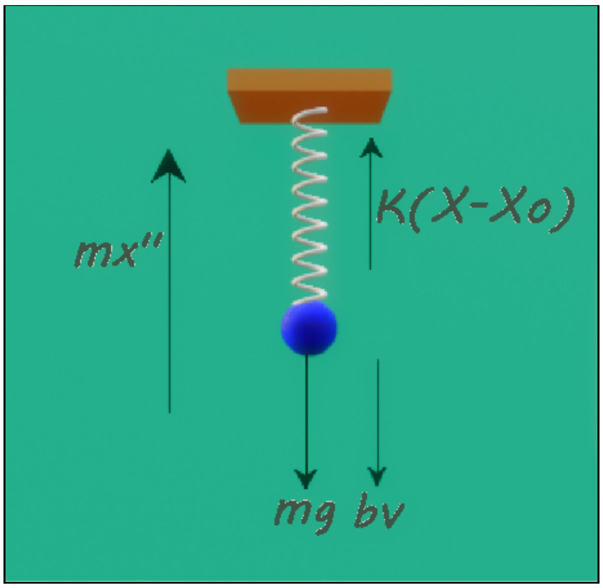
To display the physical motion of the spring mass damped oscillator system, position of the mass as a function of time was to be calculated.

The following diagram displays the forces acting on the mass



Writing force equations we get->

mx″ = -mg + k(x + x0) - bv
x″ = -g + k(x + x0) - bv/m
X0 = initial position of ball
b = damping coefficient

Method 1:

If we consider acceleration change to be almost constant during every frame change

dv = vf - vi = dt(-g + k(x + x0) -b*v/m)
Or v(t) = v(t-dt) + dt*(-g + k(x + x0) - b*v/m)

Now velocity can be calculated using incremental arithmetic very easily.

Once we get velocity,
v = dx/dt
x(t) = x(t-dt) + v*dt
x can also be computed using **incremental arithmetic** only which saves a lot of time!!

Though this method is a little inaccurate but is fastest because of minimal computations.

Method 2:
We can solve the above 2nd order DE to get x(t) and change x accordingly
A general solution of the above second order DE is
X(t) = A0*cos(w*t + phi)+ C
Where A0, phi and C can be found by proper substitution.
This is most accurate however a little expensive due to computations involving cosines and inverse functions.

Alternative to solving by hand we can use the **scipy library of python**(the **odeint** method) which can do this computation for us.
(see code2.py)

Designing of spring-mass System:
The Spring was designed by using a **screw modifier** on a circle. Ball was attached to the end of the spring.
Colors were added in the attributes section, and given realistic view to the plank(wooden touch) and spring(metallic touch)

LIST OF USED REFERENCES→
1.) Blender 3.1 Python API Documentation
2.) Blender Guru - YouTube
3.)AP French(waves and oscillation)textbook reference

HOW CAN THIS SYSTEM BE EXPANDED→

Any harmonic motion(occuring in the physical world) is a combination of SHM with damping. Similar approach can be used to design those real movements.

Some of the physical motions which are **oscillatory in nature** are→

1.)movement of ripples in water.

2.)movement of cloth/hairs in the wind.

Any complex motion of objects can be represented in the form of physical equations.

If we know the equation of motion of the object, we can easily make that motion using blender python.

Contribution of Each member:

Though the project the completed by cumulative efforts of both in every stage, but primarily

Yugal Joshi: Designed spring and mass system in blender, and

Shashank Agrawal: Did Programming part.