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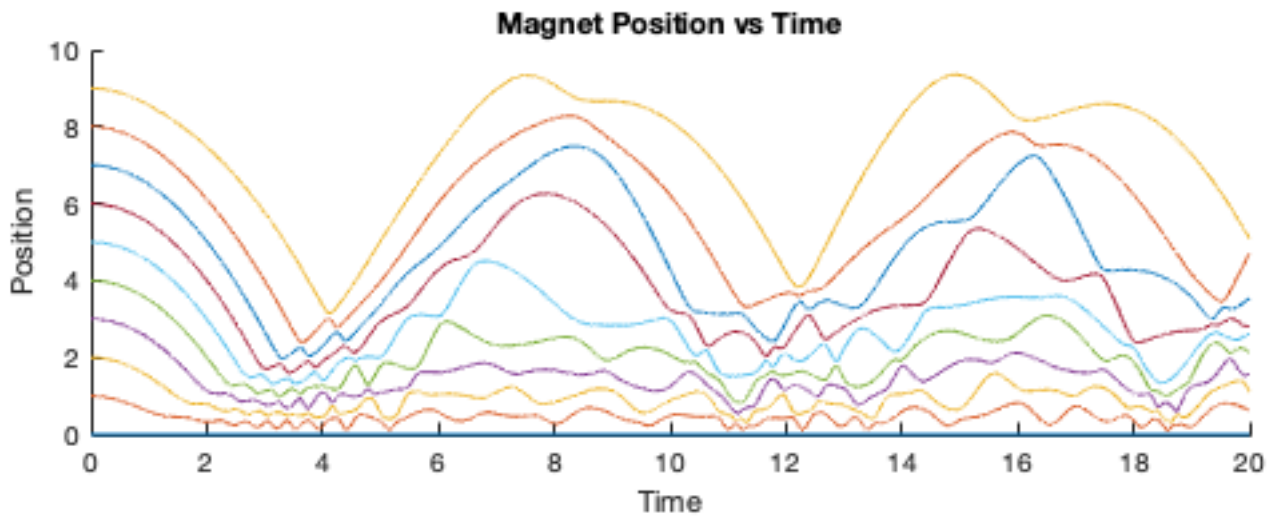
```
%Tyler Matthews
%System Simulation Final
%P1

clear all; clc; close all;
startTime = 0;
stopTime = 20;
T = 0.001;

N = stopTime/T;
t = linspace(startTime,stopTime,stopTime/T);


xArr = [
zeros(1,N);%x0
zeros(1,N);%x1
zeros(1,N);%x2
zeros(1,N);%x3
zeros(1,N);%x4
zeros(1,N);%x5
zeros(1,N);%x6
zeros(1,N);%x7
zeros(1,N);%x8
zeros(1,N);%x9
10*ones(1,N);%x10
];

%Initial Values
xArr(2,1) = 1;%x1
xArr(3,1) = 2;%x2
xArr(4,1) = 3;%x3
xArr(5,1) = 4;%x4
xArr(6,1) = 5;%x5
xArr(7,1) = 6;%x6
xArr(8,1) = 7;%x7
xArr(9,1) = 8;%x8
xArr(10,1)= 9;%x9

for k = 2:10
    fx = -1 + (1/(xArr(k,1) - xArr(k-1,1))^2) - (1/(xArr(k+1,1) - xArr(k,1))^2);
    xArr(k, 2) = xArr(k,1) + (T^2/2)*fx;
end


for j = 3:N %columns
    for k = 2:10 %rows
        f1 = -1 + (1/(xArr(k,j-1) - xArr(k-1,j-1))^2) - (1/(xArr(k+1,j-1) - xArr(k,j-1))^2);
        xArr(k, j) = 2*xArr(k,j-1) - xArr(k,j-2) + T^2*f1;
```

```
        %x1(k) = 2*x1(k-1)-x1(k-2)+T^2*f1(k-1);
    end
end
```

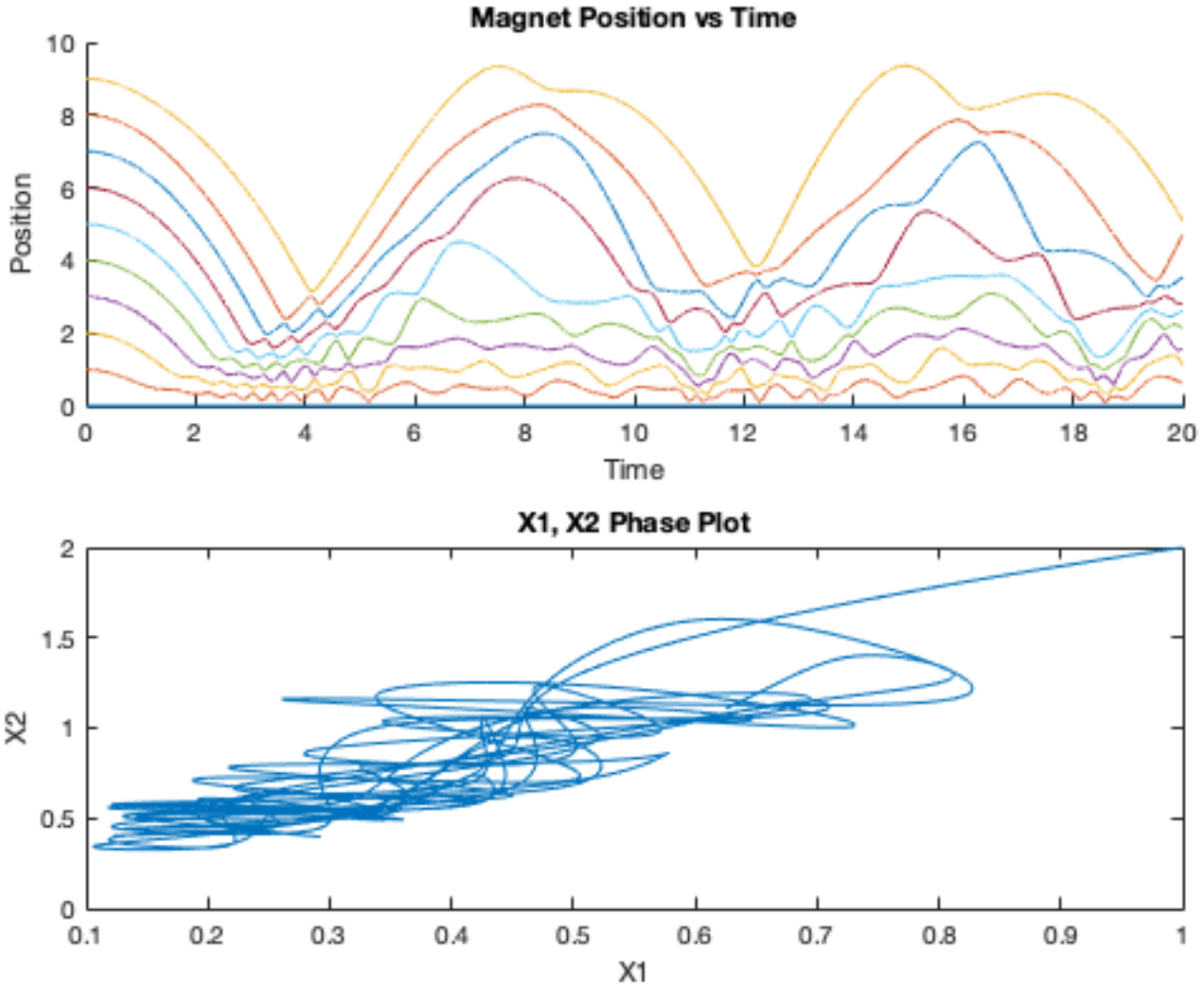
PART A

```
figure;
subplot(2,1,1);
hold on;
title('Magnet Position vs Time')
ylabel('Position')
xlabel('Time')
for k = 1:10
   plot(t, xArr(k,:))
end
hold off;
```



PART B

```
subplot(2,1,2);
plot(xArr(2,:), xArr(3,:))
title('X1, X2 Phase Plot')
ylabel('X2')
xlabel('X1')
```



PART C

```
disp('This system is extremely sensitive to its inital conditions, so it must be chaotic')
```

```
This system is extremely sensitive to its inital conditions, so it must be chaotic
```

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