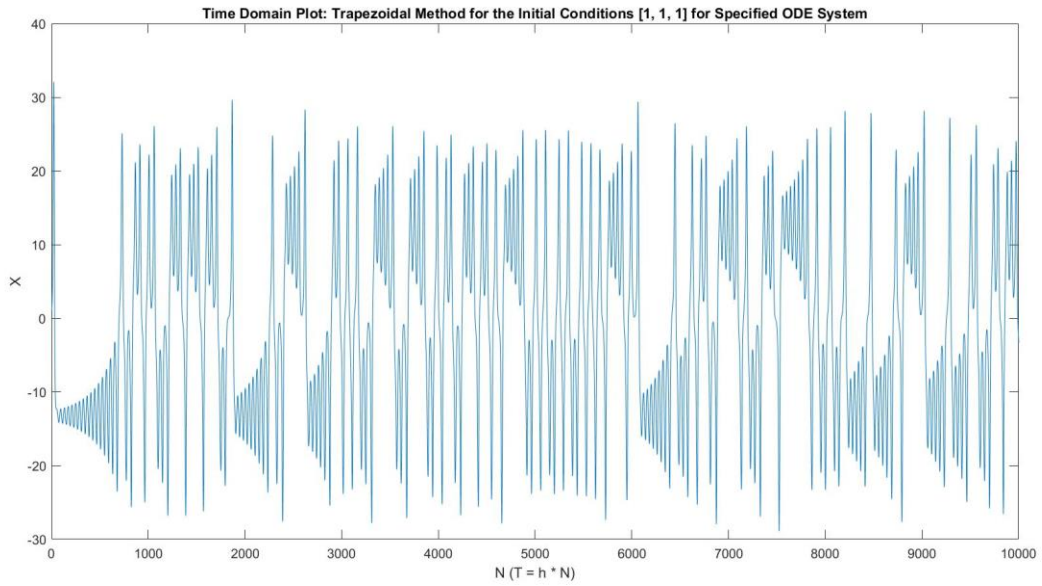
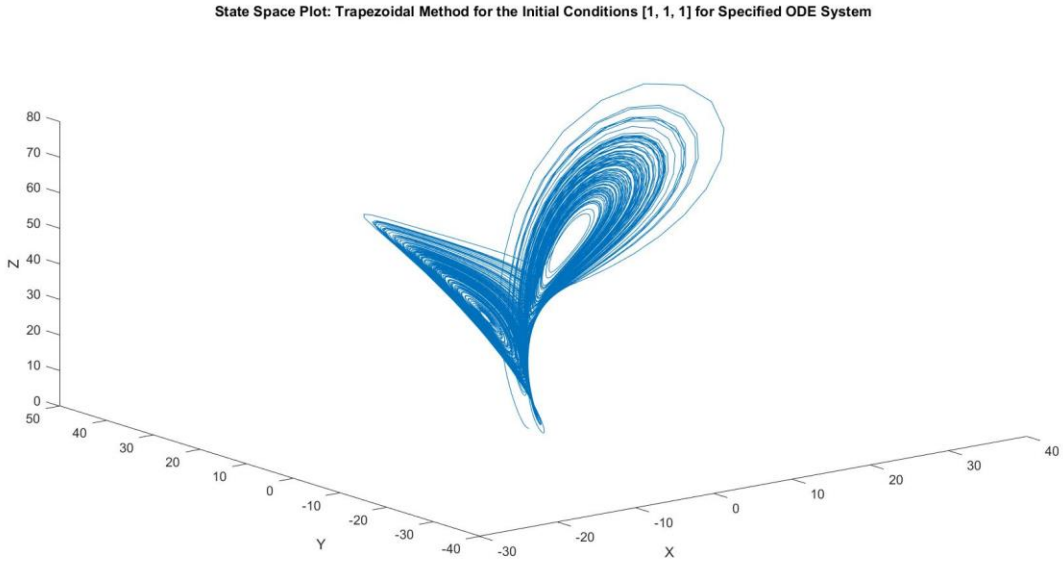
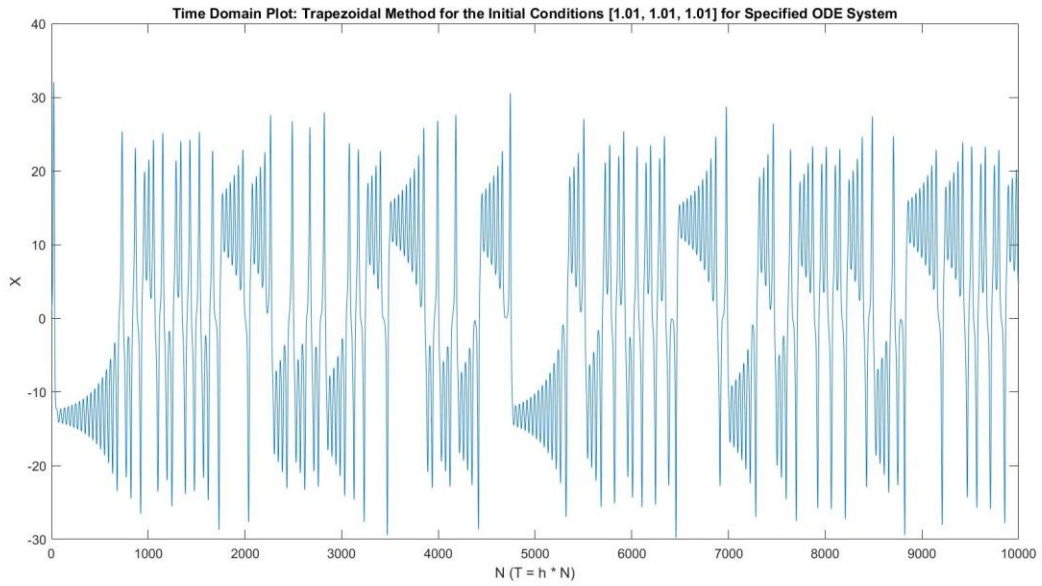
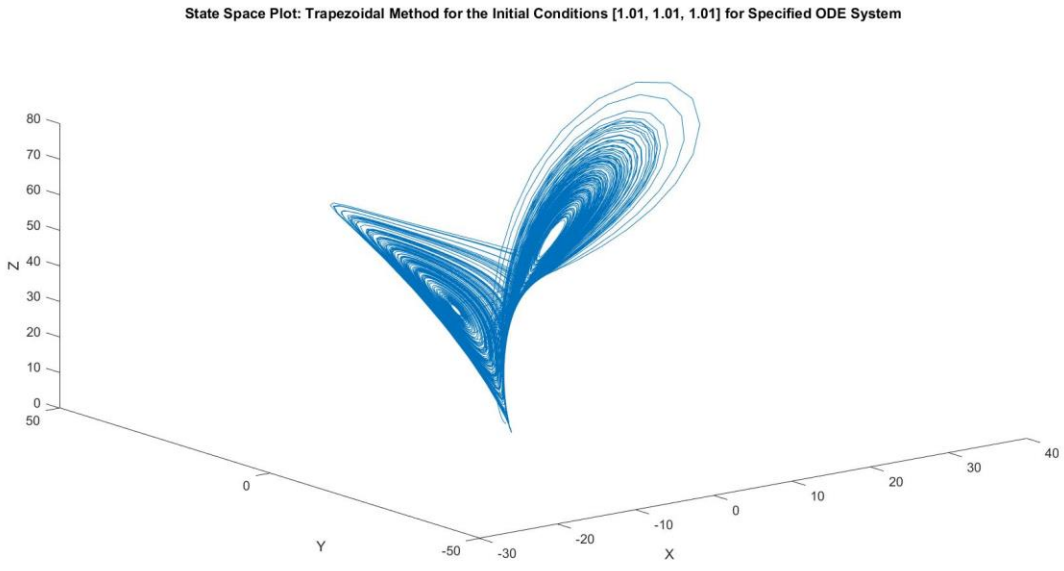
CSCI3656_ProblemSet13_1.m

```
function [ output ] = CSCI3656_ProblemSet13_1( initCond, h, N )

output = [];

for i = 1 : N
    % OLD: Used for Backwards Elimination Plane Slope
        % Vector [x, y, z]^T set into values
    x = initCond(1, 1);
    y = initCond(2, 1);
    z = initCond(3, 1);

        % ODE System Equations
    xDot = 16 * (y - x);
    yDot = 45*x - y - x*z;
    zDot = x*y - 4*z;

        % 3D Slope into Array
    slopePlane = [xDot; yDot; zDot];

    % NEW: Trapizoidal, Forward Elimination Step for Plane Slope
    forwardElimTestStep = CSCI3656_ProblemSet12_4( initCond, h, 1 );
    xForwardElim = forwardElimTestStep(1, 1);
    yForwardElim = forwardElimTestStep(2, 1);
    zForwardElim = forwardElimTestStep(3, 1);

    xDotForwardElim = 16 * (yForwardElim - xForwardElim);
    yDotForwardElim = 45*xForwardElim - yForwardElim - xForwardElim*zForwardElim;
    zDotForwardElim = xForwardElim*yForwardElim - 4*zForwardElim;

    forwardElimSlopePlane = [xDotForwardElim; yDotForwardElim; zDotForwardElim];

    % OLD: ForwardElim Setting up for next loop
        % newCond = initCond + h * slopePlane;

    % NEW: Trapizoidal, averages ForwardElim slope and BackwardElim slope
    newCond = initCond + h/2 * (slopePlane + forwardElimSlopePlane);

    output = [output, newCond];
    initCond = newCond;
end
```

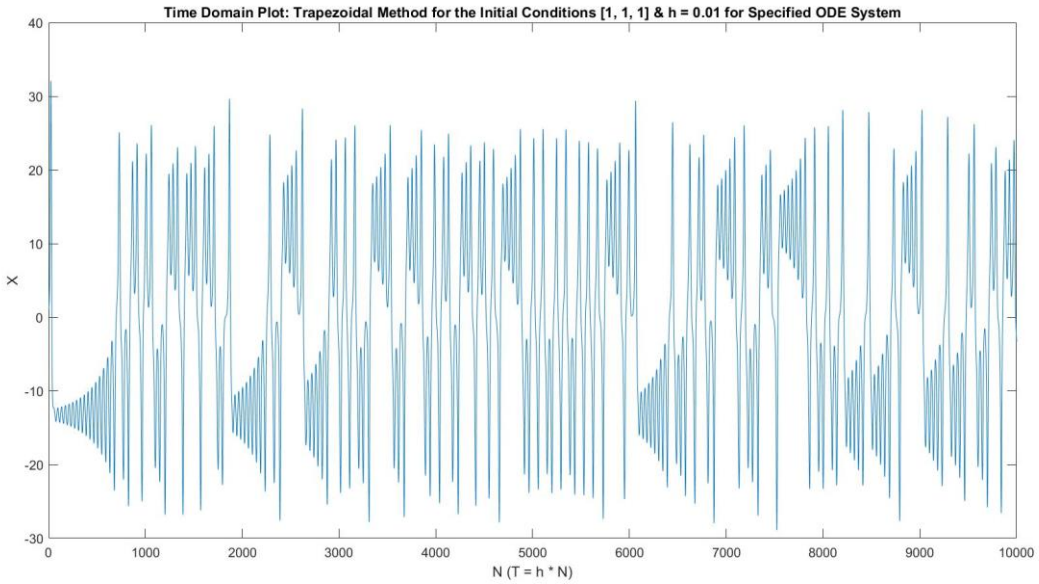

Time Domain Plot: Trapezoidal Method for the Initial Conditions [1, 1, 1] for Specified ODE System
X
N (T = h * N)
40
30
20
10
0
-10
-20
-30
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

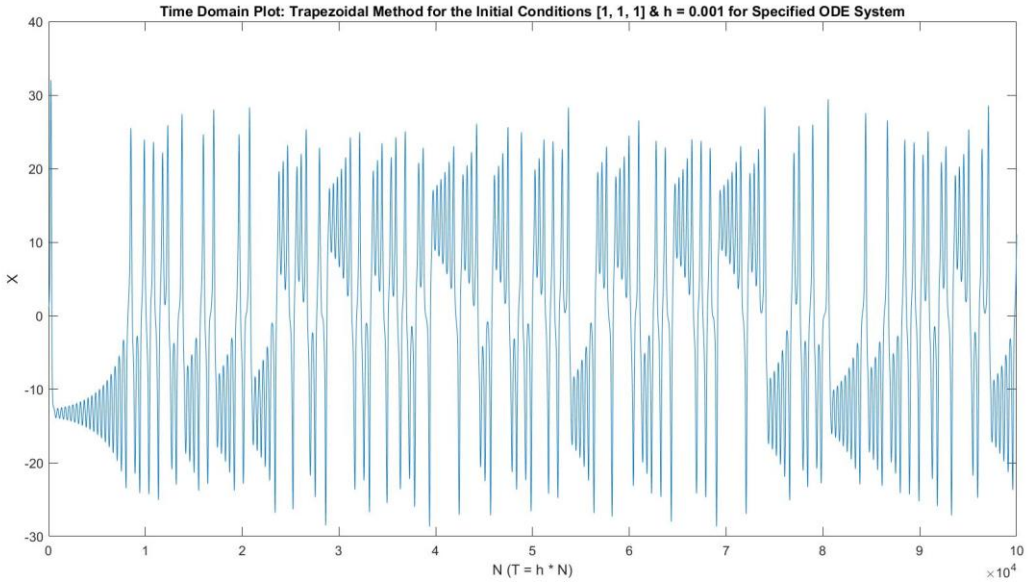

State Space Plot: Trapezoidal Method for the Initial Conditions [1, 1, 1] for Specified ODE System
Z
Y
X
80
70
60
50
40
30
20
10
0
50
40
30
20
10
0
-10
-20
-30
-40
-30
-20
-10
0
10
20
30
40

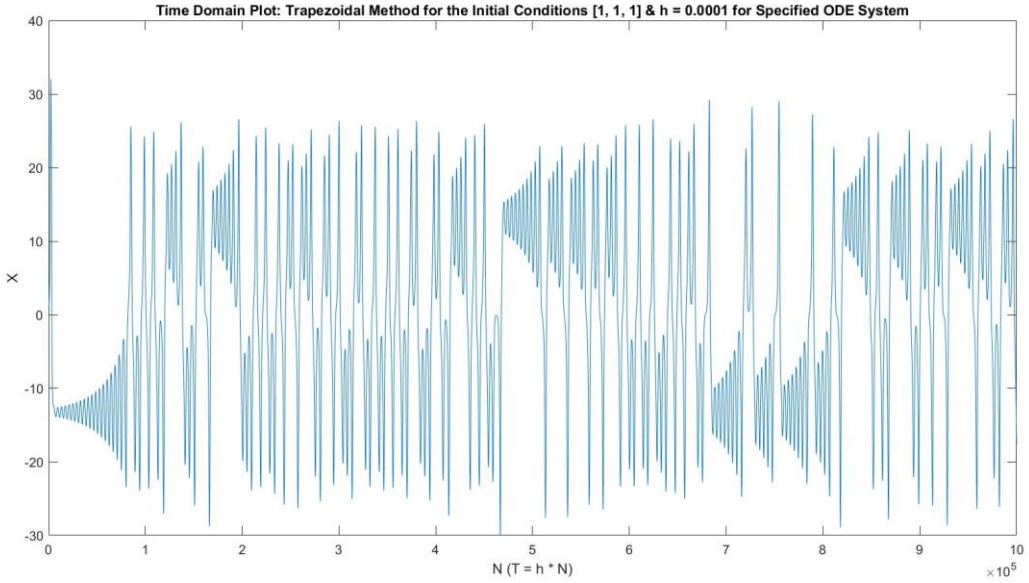

Time Domain Plot: Trapezoidal Method for the Initial Conditions [1.01, 1.01, 1.01] for Specified ODE System
X
N (T = h * N)
40
30
20
10
0
-10
-20
-30
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000


State Space Plot: Trapezoidal Method for the Initial Conditions [1.01, 1.01, 1.01] for Specified ODE System
Z
Y
X
80
70
60
50
40
30
20
10
0
50
0
-50
-30
-20
-10
0
10
20
30
40

```
>> CSCI3656_ProblemSet12_4( [1; 1; 1], 0.01, 10000 )
>> transpose(ans)
>> plot(ans(:,1));
>> plot3(ans(:,1),ans(:,2),ans(:,3));

>> CSCI3656_ProblemSet13_1( [1.01; 1.01; 1.01], 0.01, 10000 )
>> transpose(ans)
>> plot(ans(:,1));
>> plot3(ans(:,1),ans(:,2),ans(:,3));

>> CSCI3656_ProblemSet13_1( [1; 1; 1], 0.01, 10000 )
>> transpose(ans)
>> plot(ans(:,1));

>> CSCI3656_ProblemSet13_1( [1; 1; 1], 0.001, 100000 )
>> transpose(ans)
>> plot(ans(:,1));

>> CSCI3656_ProblemSet13_1( [1; 1; 1], 0.001, 1000000 )
>> transpose(ans)
>> plot(ans(:,1));
```


Time Domain Plot: Trapezoidal Method for the Initial Conditions [1, 1, 1] & h = 0.01 for Specified ODE System
X
N (T = h * N)


Time Domain Plot: Trapezoidal Method for the Initial Conditions [1, 1, 1] & h = 0.001 for Specified ODE System
X
N (T = h * N)
×10^4


Time Domain Plot: Trapezoidal Method for the Initial Conditions [1, 1, 1] & h = 0.0001 for Specified ODE System
X
N (T = h * N)
×10^5