

Cobweb Plots

Implementation in MATLAB

Cobweb Plots

The COBWEB plots are plotted with the help of two functions namely **cobweb** and **functent**. The operation of both functions is shown below:

Functent:

Functent function consists of the function whose cobweb plot is to be plotted. It takes the initial value of x , n number of iterations to be performed and returns the output y after computing the function for n times. It computes the results in a recursive way. The output of the i th iteration is the input for the next iteration. After computing the result, the functent returns the output value.

Cobweb:

The cobweb function consists of multiple computations and plots, plotted on a single figure to give a final plot. The function works with the following flow:

1. User enters the initial value x_0 to be put in the function.
2. Numbers of iterations are entered by the user.
3. Repeat count for mapping is entered by the user.
4. An initial plot of $y=x$ is made. X is an array containing 10000 equidistant points from 0 to 1.
5. A mapping plot is plotted on the same figure using the functent function output values as y axis and x on x -axis.
6. A tent map values are found and plotted by calling the functent function for each of the x value.

7. It must be noted that previously in mapping plot, a whole array of x was given while in tent map, each value of x is given separately and the function is called in a loop for each value of x.
8. Once the tent map has been plotted, a simple Matlab code has been written to start from the initial point x_0 and keep moving the point first vertically till it reaches the tent map point. Once reached, it starts moving horizontally till it again touches the tent map point.
9. The process for vertical and horizontal lines is repeated again and again till last iteration.
10. The final iteration which yielded us the result is displayed on the command window.

A display of the cobweb plot of the values given below, is shown:

Function $\rightarrow Y=2*\text{parameter}*(0.5-\text{abs}(X-0.5))$;

$X_0 \rightarrow 0.23$, Maximum Iterations $\rightarrow 3$, Repeat Count $\rightarrow 1$, Parameter $\rightarrow 1$

Code:

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% COBWEB PLOT %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

clear all;
close all;
clc;
clf;
%fontSize=12; % font size.

x(1)      = input(' Enter the value of initial condition x0: ');
iterate   = input(' Enter the maximum number of iterations : ');
rep_count = input(' Enter repeat count for mapping           : ');
param     = input(' Enter the parameter value               : ');

% Defining x-axis
xn=0: 1/10000 :1;

figure;
whitebg('black');
plot(xn,xn,'blue'); % Plotting y=x
hold on;
plot(xn,functent(xn,rep_count,param),'g-'); % Plot the function in functent

% Labelling axis and title
title('Cobweb diagram for Tent map. ');
xlabel('x');
ylabel('T_r^[^n^](x)');

fprintf('\n _____ ')
fprintf('\n Repeat Count      Iterate ') % Print table header
fprintf('\n _____ \n')

% Finding and plotting tent map
for i=1:iterate
    x(i+1) = functent(x(i),rep_count,param);
    fprintf('      %3.0f\t\t %10.10f \n', i,x(i+1)) %Print iterate
end
fprintf('\n _____ \n')

% Drawing the cobweb plots

xb(1)=0;
xb(2)=x(2);

for i=1:iterate
    xa(2*i-1) =x(i);
    xa(2*i)   =x(i);

    if i>1
        xb(2*i-1) =x(i);
        xb(2*i)   =x(i+1);
    end
end
```

```
xh=[xa(i-1) xa(i)];  
yh=[xb(i)   xb(i)];  
plot(xh,yh,'r:');
```

end

```
xv=[xa(i) xa(i)];  
yv=[xb(i) xb(i+1)];  
plot(xv,yv,'r')
```

end

```
fprintf(' Final iteration is %10.10f \n', x(i+1))
```

%%%

Results:

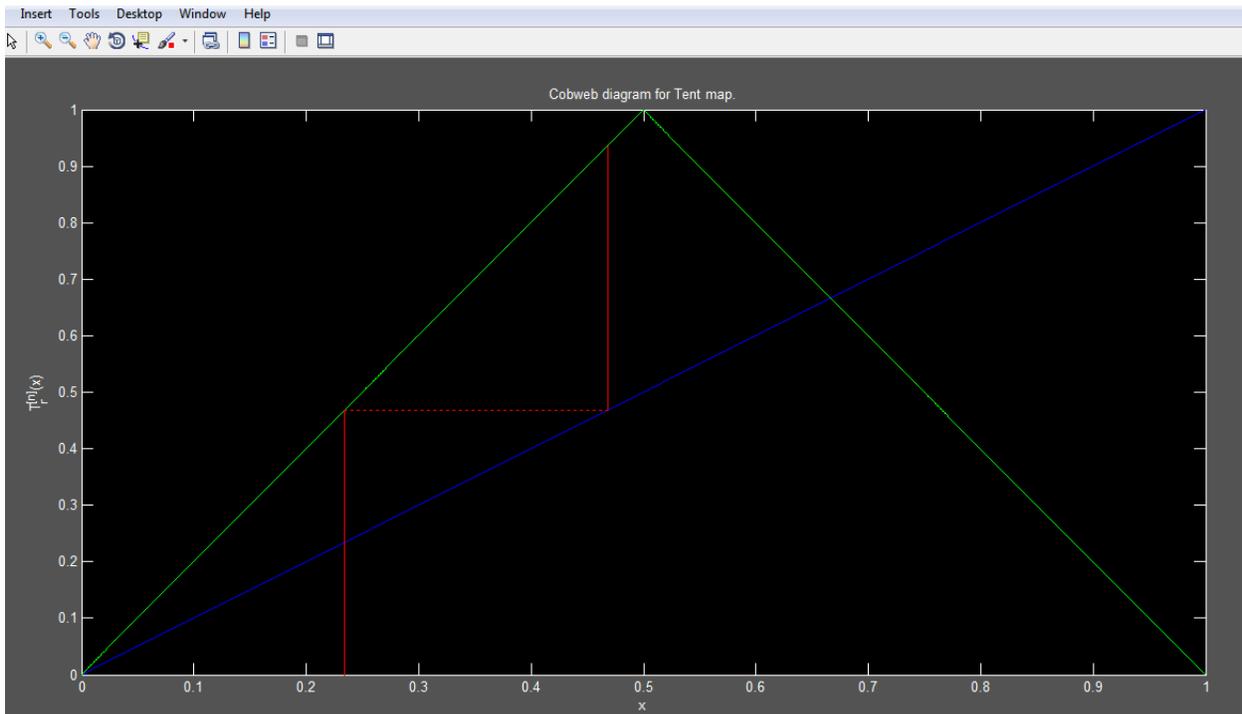


Figure 1 Cobweb Plot for the function $F(x)$