

CIE 327-Project

S.P. Analyzer Report

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Input generation:

```
% %  
% Mohamed Zayed Ahmed (201800760)  
%part 1:  
%First Test Case  
clear;clc;  
theta = unifrnd(0,2*pi,1000);  
omega_c = 3/4*pi;A = 4;  
t = (-10:0.01:4.99);  
for i =1:1000  
X = (A*sin((omega_c *t)+theta(i,:).'))+(0.5*A*cos((2*omega_c *t)+(theta(i,:).'/3)));  
end  
  
save('Yinputs.mat','X','t');
```

The input to the project is a .mat file containing a matrix (X) :The ensemble Matrix, and the time vector (t). They are saved by the built in mat function save. The upbove image shows a test case saving. Any input must be saved to a .mat file containing the ensemble matrix (X) and time vector (T).

Using The SPCalc:

After Generating the *.mat file containing the X(ensemble matrix) and the time vector(t). Open the GUI app SPCalc. Then load the .mat file using the load button.

Stochastic Processes Calculator

Main Operations Samples Plot RP Properties Plot

Important Note:
Inputs must be (X) and (t)

Loading Inputs: Load

Loaded The Input From inputs.mat : X(t) Matrix and Time t vector.

No. of sample Functions: 5 set

Calculating time mean of specific sample Function:

The Sample No.: 25 set Time-Mean: -18.003260 get

Calculating Total average power of the process: Calculating Time ACF of n-th:

Total Avg. Power: 104.1980 get The Sample No.: 29 set

Time ACF: 14168.10253 get

Plotting:

Sample Functions: Plot

Ensemble mean: Plot

Stat. ACF: 12 32 Plot 48526.02484

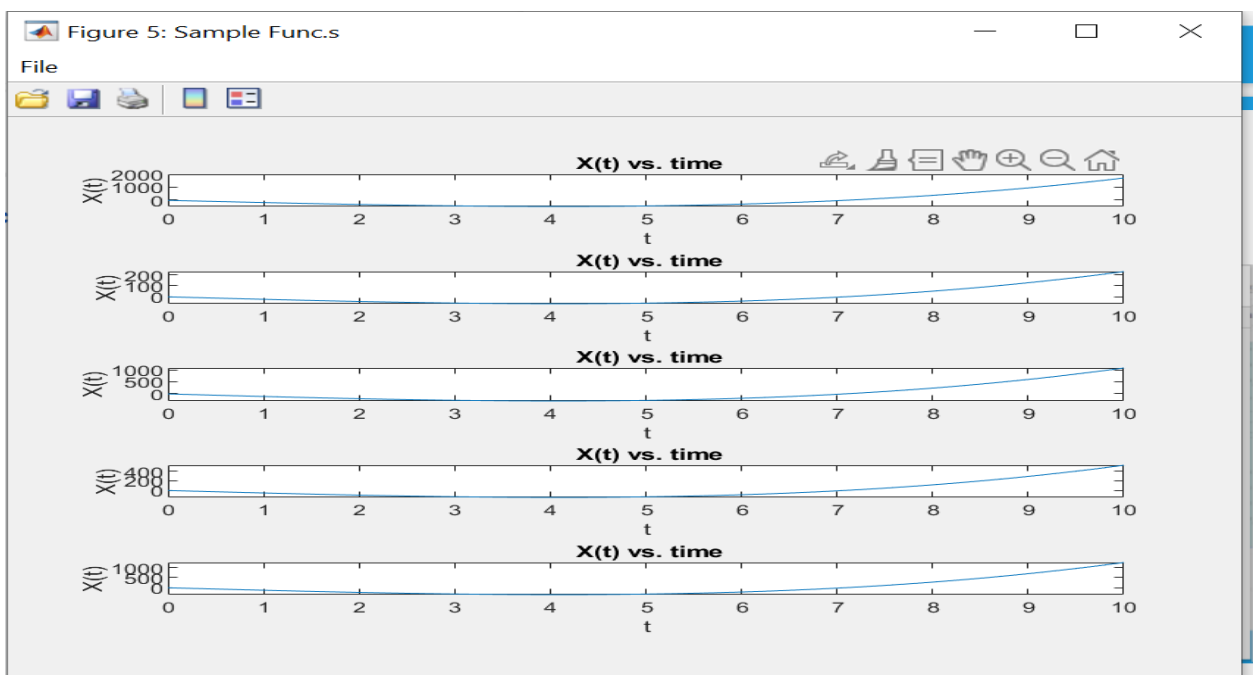
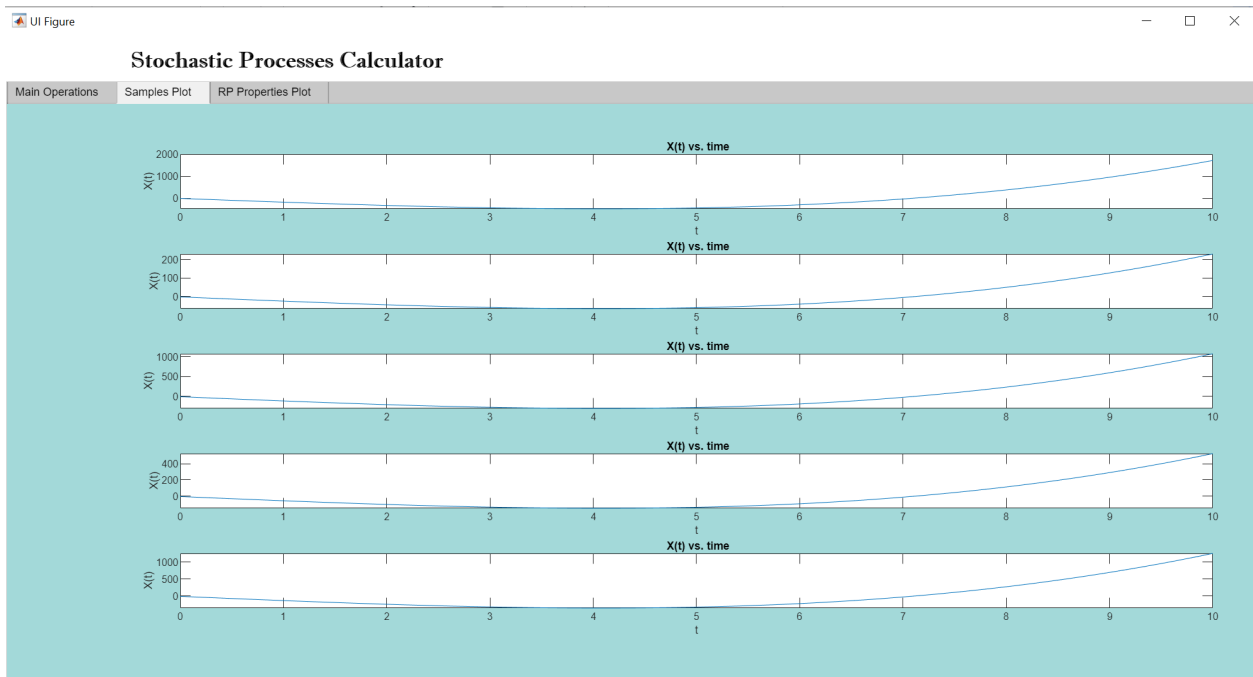
Power Spectral Density: Plot

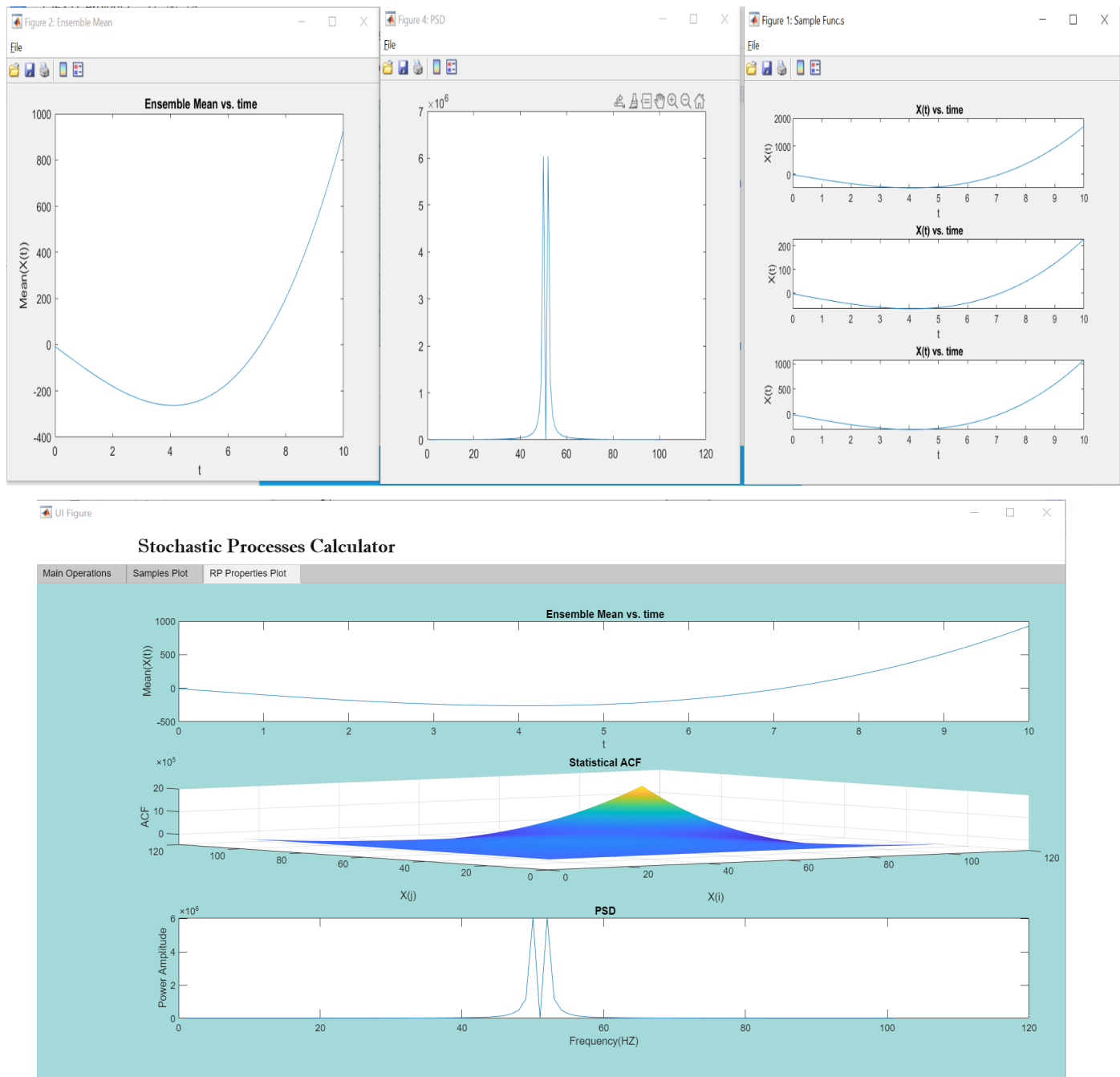
The loading label changes from wait for loading to Loaded message. Then use the functionalities of the calculator. Zero values in the Edit Fields must be changed to an acceptable value.

Each Plot is done twice. Once in the specified tab which is either The Sample Function plot tab or the RP Properties Tab and the other plot is in an external separate Figure window.

Results for (Sample_Process.mat):

There's very little difference between the 5 samples, as they show the same behavior of declining then re-increasing and ending up at a bigger value than the initial value as if it's an exponential increase.

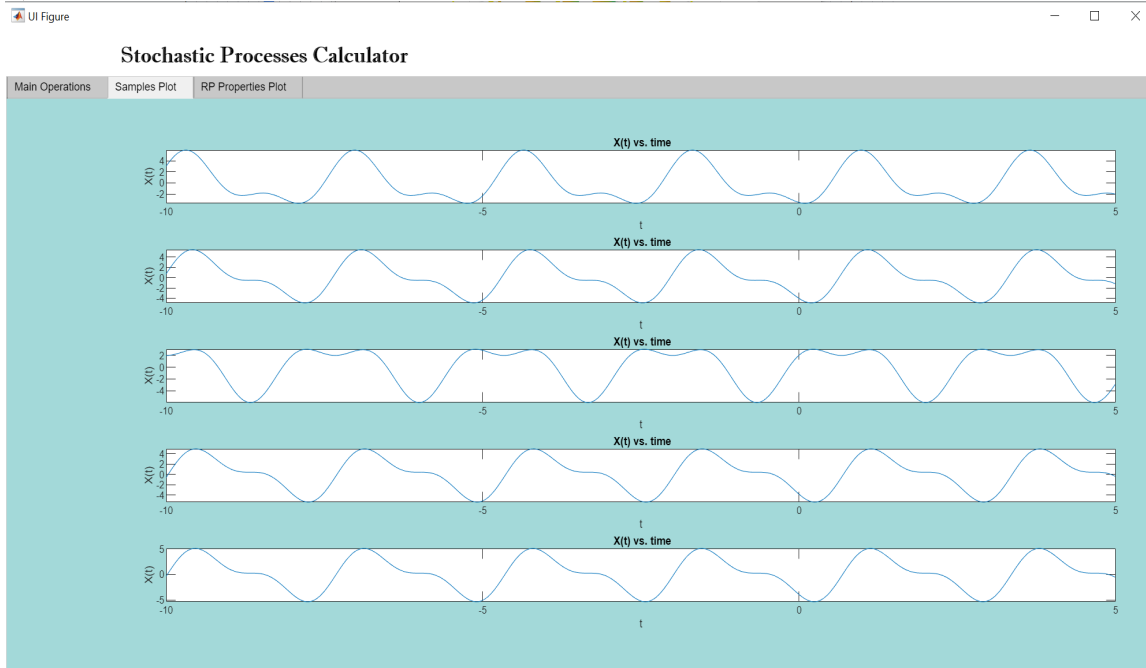
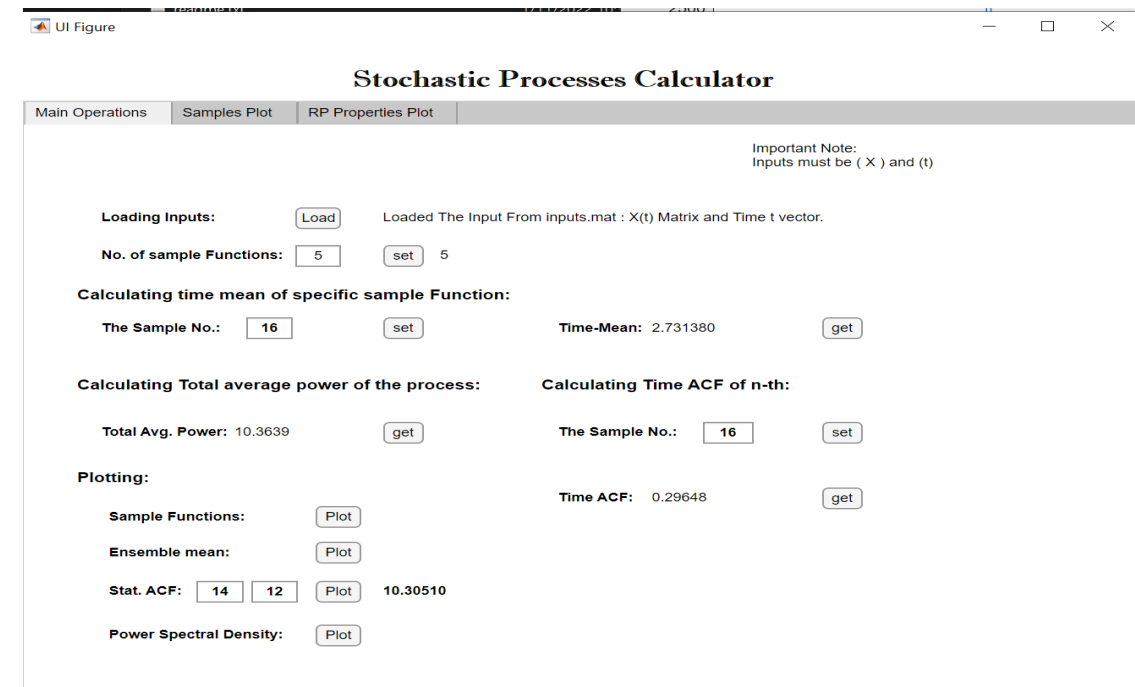




The Ensemble mean shows that the samples aren't so varied from each other because the mean shows the same act of declining then increasing in a semi-exponential behavior. The ACF of the process shows the same behavior as the samples itself as the ACF moving along (i) and (j) is decreasing then approximately exponentially re-increasing till the end of the ACF.

Results for (Generated input of Y function):

The file inputs.m generates the input of Y function. Loading the inputs in the application resulted in a periodic function of summation of sin and cos for 1000 thetas. Time ACF not equal ACF and mirroring is present in the PSD graph. The ACF plot has a similar periodic behavior as the source function.



Ensemble mean appears to follow a sinusoidal wave as it was the average of summation of sin and cos functions.

