**Signal and Systems Final Project**

**(Matlab)**

**Part 2**

**General Signal Generator**

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**Source Code**

clc , clear , close all

msg1 =( ' >>General Signal Generator<< ' );

disp (msg1)

frequencySampling = input ( ' Enter the Sampling Frequency of the signal: ' );

while (frequencySampling < 0)

frequencySampling = input ( ' Please Enter a valid number for the sampling frequency: ' );

end

startTimeScale = input ( ' Enter the start of the time scale: ' );

endTimeScale = input ( ' Enter the end of the time scale: ' );

breakPointNumber = input ( ' Enter the number of break points: ' );

while (breakPointNumber < 0)

breakPointNumber = input ( ' Please Enter a valid number of break points: ' );

end

start = startTimeScale;

signalTotal = 0;

for i = 1:(breakPointNumber + 1)

userBreakPoint = endTimeScale;

fprintf ( ' Created Signal \n ' );

if (i ~= (breakPointNumber + 1))

userBreakPoint = ceil(input ( ' Enter the break point position: ' ));

end

fprintf ( ' 1- DC Signal \n 2- Ramp Signal \n 3- General Order Polynomial \n 4- Exponential Signal \n 5- Sinusoidal Signal \n ');

signalType = input ( ' Choose the type of signal you want: ');

while (signalType > 5 || signalType < 1)

signalType = input ( ' Please Enter a valid choice: ');

end

t = linspace(start,userBreakPoint,(userBreakPoint - start) \* frequencySampling);

switch (signalType)

case 1

amp = input ( ' Enter the amplitude of the signal: ');

n = (userBreakPoint - start) \* frequencySampling;

x = amp\*ones(1,n);

case 2

slope = input( ' Enter slope: ');

intercept = input( ' Enter the intercept with x-axis: ');

x = slope \* (t-intercept);

case 3

numberCoefficient = input ( ' Enter the number of coefficients: ');

power = numberCoefficient - 1;

x = 0;

for j = 1:(numberCoefficient)

coefficient = input ( ' Enter coefficient: ' );

x = x + coefficient \* t.^power;

power = power - 1;

end

case 4

amp = input ( ' Enter the amplitude of the signal: ');

exponent = input ( ' Enter the exponent: ' );

x = amp \* exp(exponent \* t );

case 5

amp = input ( ' Enter the amplitude of the signal: ');

frequency = input( ' Enter the frequency: ');

phase = input( ' Enter the phase: ');

x = amp \* sin((2 \* pi \* frequency \* t) + deg2rad(phase));

end

start = userBreakPoint;

signalTotal = [signalTotal x];

end

T = linspace(startTimeScale,endTimeScale,(frequencySampling\*((endTimeScale-startTimeScale))+1));

figure

plot (T, signalTotal)

title( ' The Desired Signal ' );

msg2 =( ' >Operations on Created Signal< ' );

disp (msg2)

operationNumber = input( ' Enter the number of operations you want to do: ' );

while (operationNumber < 0)

operationNumber = input ( ' Please Enter a valid number of operations: ' );

end

for k = 1:(operationNumber)

fprintf ( '1- Amplitude Scaling \n 2- Time Reversal \n 3- Time Shift \n 4- Expanding the signal \n 5- Compressing the signal \n 6- None \n ');

option = input( ' Choose the number of the operation you want: ' );

while (option > 6 || option < 1)

option = input ( ' Please Enter a valid choice: ');

end

switch (option)

case 1

amp = input ( ' Enter the new amplitude of the signal: ');

T = amp \* T;

case 2

T = -T;

case 3

phaseShift = input ( ' Enter the value of the shift: ' );

T = T - phaseShift;

case 4

expansion = input ( ' Enter the value of expansion: ' );

T = T \* expansion;

case 5

compression = input ( ' Enter the value of compression: ' );

T = T / compression;

case 6

break;

end

end

figure

plot(T,signalTotal)

title( ' The Modified Signal ' );

fprintf ( ' >>Thank You<< \n ');

**Test Cases**

**Example 1**

* Fs = 3000
* Start = -3
* end = 3
* break point number (BPN) = 0
* General Order Poly 🡪 Number of coefficients = 3 , Coefficients = 1,-6,6
* Operations number (ON) = 2
* Time Reversal
* Time Shift = 4

Chart

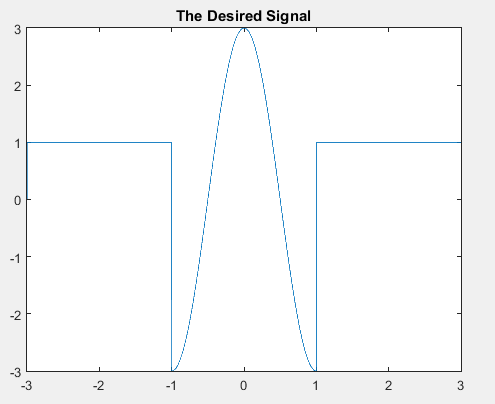
Description automatically generated

Chart, line chart

Description automatically generated

**Example 2**

* Fs = 4500
* Start = -3
* end = 3
* break point number (BPN) = 2
* break point position (BPP) = -1,1
* DC 🡪 Amplitude = 1
* Sinusoidal 🡪 Amplitude = 3 , Frequency = 0.5 , Phase =90
* DC 🡪 amplitude = 1
* Operations number (ON) = 1
* Expanding the signal = 4



Chart, histogram

Description automatically generated

**Example 3**

* Fs = 1000
* Start = 0
* end = 10
* break point number (BPN) = 1
* break point position (BPP) = 5
* Ramp 🡪 slope = 3 , Intercept ( with x-axis ) = 2
* Exponential 🡪 Amplitude = 5 , Exponent = 2
* Operations number (ON) = 1
* Time Reversal

Chart

Description automatically generated

Chart

Description automatically generated

**Example 4**

* Fs = 5000
* Start = -1
* end = 3
* break point number (BPN) = 1
* break point position (BPP) = 1
* Sinusoidal 🡪 Amplitude = 2 , Frequency = 2 , Phase = 0
* DC 🡪 Amplitude = 1
* Operations number (ON) = 2
* Amplitude Scaling = 3
* Time Shift = 1

Chart, histogram

Description automatically generated

Chart, histogram

Description automatically generated

**Example 5**

* Fs = 1500
* Start = 0
* end = 6
* break point number (BPN) = 2
* break point position (BPP) = 3,5
* General Order Poly 🡪 Number of coefficients = 3 , Coefficients = 1,-6,6
* Exponential 🡪 Amplitude = 2 , Exponent = 1
* DC 🡪 Amplitude = 3
* Operations number (ON) = 3
* Amplitude Scaling = 2
* Time Shift = -2
* Time Reversal

Chart, histogram

Description automatically generated

Chart, histogram

Description automatically generated

**Example 6**

* Fs = 2500
* Start = 0
* end = 8
* break point number (BPN) = 2
* break point position (BPP) = 3,5
* Ramp 🡪 Slope = 1 , Intercept with x-axis = 0
* Sinusoidal 🡪 Amplitude = 2 , Frequency = 0.25 , Phase = 0
* DC 🡪 Amplitude = 2
* Operations number (ON) = 2
* Amplitude Scaling = 2
* Time Shift = -3

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated

**Example 7**

* Fs = 7250
* Start = 0
* end = 10
* break point number (BPN) = 2
* break point position (BPP) = 3,6
* Exponential 🡪 Amplitude = 3 , Exponent = -3
* Sinusoidal 🡪 Amplitude = 1 , Frequency = 0.75 , Phase = 0
* Ramp 🡪 Slope = 3 , Intercept with x-axis = 10
* Operations number (ON) = 3
* Amplitude Scaling = 2
* Time Shift = -4
* Compressing the signal = 2

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated

**Example 8**

* Fs = 10000
* Start = -4
* end = 4
* break point number (BPN) = 3
* break point position (BPP) = -2,0,2
* DC 🡪 amplitude = 2
* General Order poly 🡪 Number of coefficients = 4 , Coefficients = 2,2,2,2
* General Order poly 🡪 Number of coefficients = 4 , Coefficients = -2,2,-1,1
* DC 🡪 amplitude = 2
* Operations number (ON) = 4
* Amplitude Scaling = 3
* Time Shift = 2
* Expanding the signal = 5
* Compressing the signal = 1

Chart

Description automatically generated

Chart

Description automatically generated

**Example 9**

* Fs = 9000
* Start = -6
* end = 6
* break point number (BPN) = 3
* break point position (BPP) = -3,0,3
* Ramp 🡪 Slope = 2 , Intercept with x-axis = -6
* Exponential 🡪 Amplitude= 1 , Exponent = 3
* DC 🡪 Amplitude = 3
* Ramp 🡪 Slope = -2 , Intercept with x-axis = 6
* Operations number (ON) = 3
* Amplitude Scaling = 2
* Time Reversal
* Expanding the signal = 3

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated

**Example 10**

* Fs = 5000
* Start = -10
* end = 10
* break point number (BPN) = 4
* break point position (BPP) = -8,-4,0,2
* Ramp 🡪 Slope = 2 , Intercept with x-axis = -10
* Sinusoidal 🡪 Amplitude = 1 , Frequency = 1, Phase = 0
* Exponential 🡪 Amplitude= 2 , Exponent = 2
* General Order Poly 🡪 Number of Coefficients = 3, Coefficients = 1,-6,6
* DC 🡪 Amplitude = 2
* Operations number (ON) = 4
* Amplitude Scaling = 3
* Time Reversal
* Time Shift = -2
* Compressing the signal = 3

Chart, histogram

Description automatically generated

Chart, histogram

Description automatically generated

**Example 11**

* Fs = 7000
* Start = -8
* end = 8
* break point number (BPN) = 5
* break point position (BPP) = -6,-3,0,3,6
* General Order Poly 🡪 Number of Coefficients = 3, Coefficients = 1,-6,8
* Sinusoidal 🡪 Amplitude = 2 , Frequency = 1, Phase =90
* Ramp 🡪 Slope = 1 , Intercept with x-axis = 0
* Exponential 🡪 Amplitude= 2 , Exponent = 1
* DC 🡪 Amplitude = 2
* General Order Poly 🡪 Number of Coefficients = 3, Coefficients = 1,-6,8
* Operations number (ON) = 4
* Amplitude Scaling = 2
* Time Reversal
* Time Shift = -3
* Expanding the signal = 2

Chart, line chart, histogram

Description automatically generated

