BMEP 5704

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Digital Lab 2

05/21/2021

Section 1 – FIR Moving Average Filter (Boxcar)

1. Graph

Chart, box and whisker chart

Description automatically generated

1. Code

function Exercise1(t)

% t be the sample times, default value be [0:1:5000]

% rectpuls func generates a rectangle puls with sample times be t-2500

% and width be 3000

% specific for x, we have the amplitude be 5

x = 5 \* rectpuls(t-2500, 3000);

% movmean func generates an array of local k-point mean values, where

% each mean is calculated over a sliding window of length k across

% neighboring elements of A

% x3 is for sliding window of 3

x3 = movmean(x, 3);

% x51 is for sliding window of 51

x51 = movmean(x, 51);

% x501 is for sliding window of 501

x501 = movmean(x, 501);

% using rand func to add noise for x, x3, x51, and x501

xn = x + rand(size(x));

x3n = x3 + rand(size(x3));

x51n = x51 + rand(size(x51));

x501n = x501 + rand(size(x501));

% ploting x, x3, x51, x501 and their corresponding with noise pulse in

% time domain

fig = figure;

subplot(2, 4, 1);

plot(t, x);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 2);

plot(t, xn);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 3);

plot(t, x3);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 4);

plot(t, x3n);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 5);

plot(t, x51);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 6);

plot(t, x51n);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 7);

plot(t, x501);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 4, 8);

plot(t, x501n);

xlim([0, 5000]);

ylim([-1, 6]);

% save all subplots in single png file

saveas(fig, 'E1.png');

Section 2 – FIR Moving Average Filter (Boxcar)

1. Graph

Chart

Description automatically generated

Graphical user interface, diagram, shape

Description automatically generated

1. Code

function Exercise2(t)

% t be the sample times, default value be [0:1:5000], 5000 total points

% 2 sin signal saves

ya = sin(2 \* pi \* 10 \* t / 5000) + 0.5;

yb = sin(2 \* pi \* 100 \* t / 5000) + 0.5;

% sum of 2 sin waves

x = ya + yb;

fig1 = figure;

% plot x in time domain

plot(t, x);

saveas(fig1, 'fig\_x.png');

% movmean func generates an array of local k-point mean values, where

% each mean is calculated over a sliding window of length k across

% neighboring elements of A

% x3 is for sliding window of 3

x3 = movmean(x,3);

% x51 is for sliding window of 51

x51 = movmean(x, 51);

% x501 is for sliding window of 501

x501 = movmean(x, 501);

% ploting x, x3, x51, x501 and their corresponding with noise pulse in

% time domain

fig2 = figure;

subplot(2, 2, 1);

plot(t, x);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 2, 2);

plot(t, x3);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 2, 3);

plot(t, x51);

xlim([0, 5000]);

ylim([-1, 6]);

subplot(2, 2, 4);

plot(t, x501);

xlim([0, 5000]);

ylim([-1, 6]);

saveas(fig2, 'fig\_movmean.png')

Section 3 - FIR Exercise

1. Graph

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated

Chart, line chart

Description automatically generated