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Lab 3: Determining and removing drawbacks of exponential and running mean

Skoltech, Group 5: Valery Nevzorov, Andrei Chemikhin, Ruslan Agishev

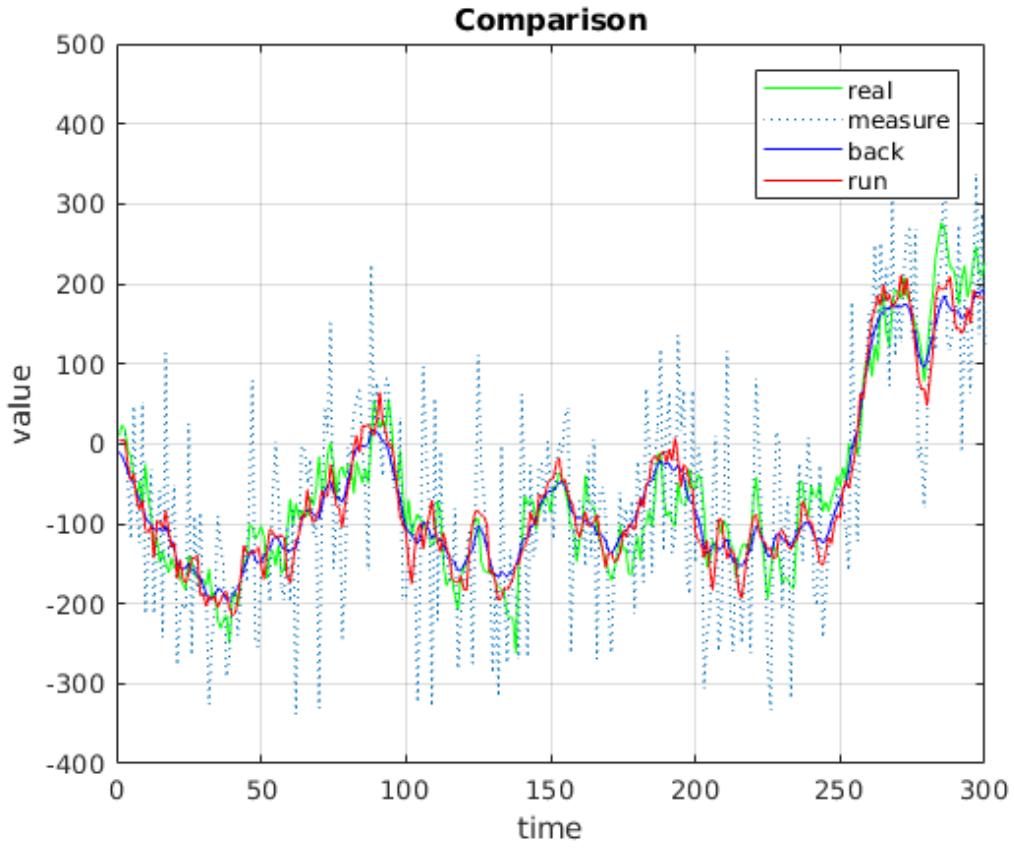
Part 1

Backward exp-smoothing

```
close all
N = 300;
x1 = 10;
sw2 = 28^2;
sn2 = 97^2;

[x, z] = trajgen(x1, sqrt(sw2), sqrt(sn2), N);
alpha = getalpha(sw2,sn2);

M = ceil( (2-alpha)/alpha );
if rem(M,2)==0
    M = M-1;
end

% estimated trajectory
r = runningmean(z,M);
t = 1:N;

e = expmean(x1, alpha, z);
xb = expmeanBack(alpha, e);

E = {e, 'exp'};
X = {x, 'real'};
Xb = {xb, 'back'};
Z = {z, 'measure'};
R = {r, 'run'};
```

```
plotting(t, X, Z, Xb, R);

[Id_xb, Iv_xb] = getindic(z, xb);
[Id_r, Iv_r] = getindic(z, r);

display(strcat('Id_xb-Id_r=',num2str(Id_xb-Id_r)));
display(strcat('Iv_xb-Iv_r=',num2str(Iv_xb-Iv_r)));
```

```
Id_xb-Id_r=-174591.7991
Iv_xb-Iv_r=-225294.9
```

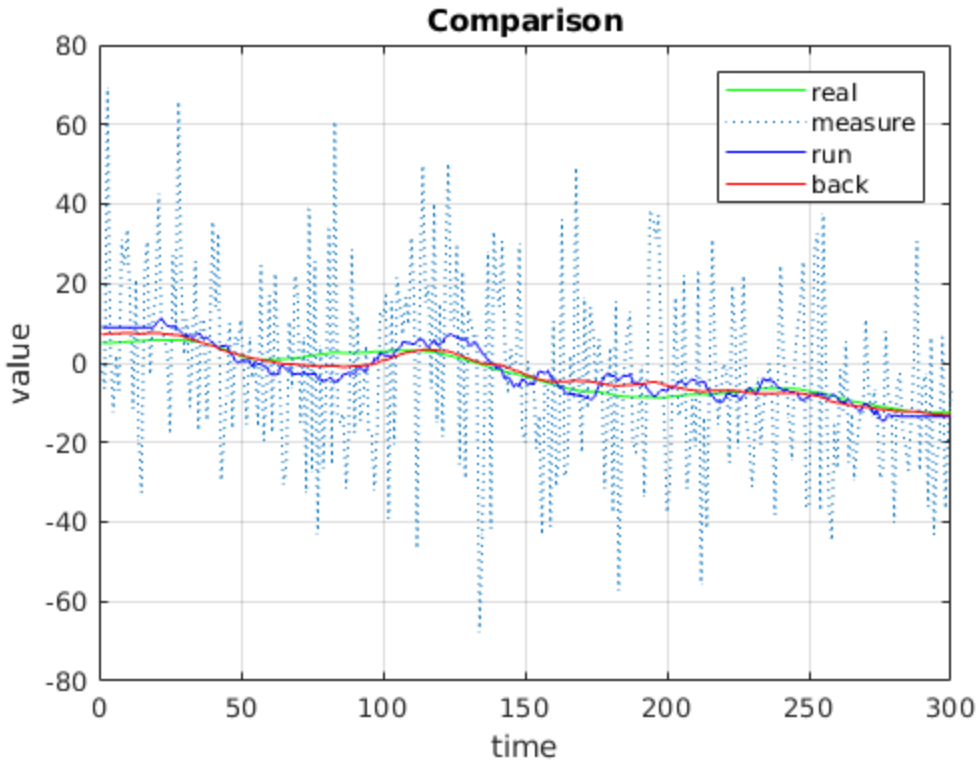


Part 2

Drawbacks of running mean

```
close all
% N = 3000;
N = 300;
sn2 = 500;
sa2 = 10;
T = 0.1;
v1 = 0;
x1 = 5;
```

```
[x, z] = trajgen_acc(x1, sqrt(sn2), sqrt(sa2), N, T, v1);

t = 1:N;

display(strcat('Variances are: sa2=',num2str(sa2),',
 sn2=',num2str(sn2)))

% generate large window for big noise removing
M = 40;
% 1/M = (2-alpha)/alpha:
alpha = 2/(M+1);
display(strcat('M=',num2str(M)));
display(strcat('alpha=',num2str(alpha)));

r = runningmean(z,M);

e = expmean(x1, alpha, z);
xb = expmeanBack(alpha, e);


E = {e, 'exp'};
X = {x, 'real'};
Xb = {xb, 'back'};
Z = {z, 'measure'};
R = {r, 'run'};

figure(1)
plotting(t,X,Z,R,Xb);

[Id_xb,Iv_xb, Id_r,Iv_r] = optindic(x1, z, M);

display(strcat('Id_xb-Id_r=',num2str(Id_xb-Id_r)));
display(strcat('Iv_xb-Iv_r=',num2str(Iv_xb-Iv_r)));


display(strcat('Id_xb=',num2str(Id_xb)));
display(strcat('Iv_xb=',num2str(Iv_xb)));
display(strcat('Id_r=',num2str(Id_r)));
display(strcat('Iv_r=',num2str(Iv_r)));

Variances are: sa2=10, sn2=500
M=40
alpha=0.04878
Id_xb-Id_r=-3405.7172
Iv_xb-Iv_r=-369.1403
Id_xb=139008.5631
Iv_xb=0.86934
Id_r=142414.2804
Iv_r=370.0096
```

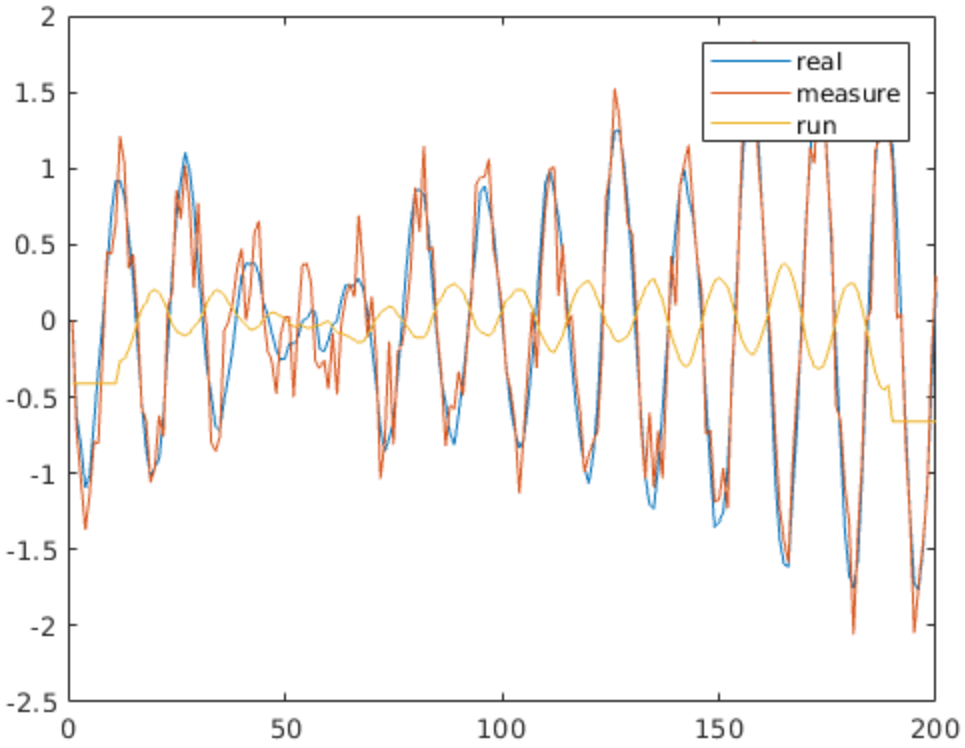


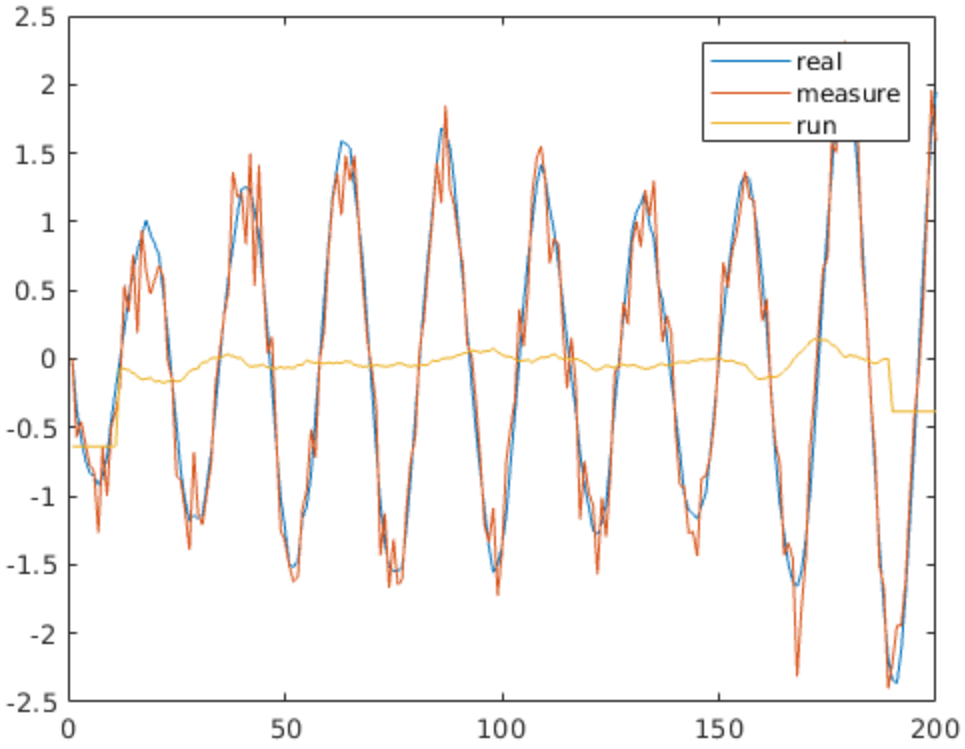
Secondary trajectory

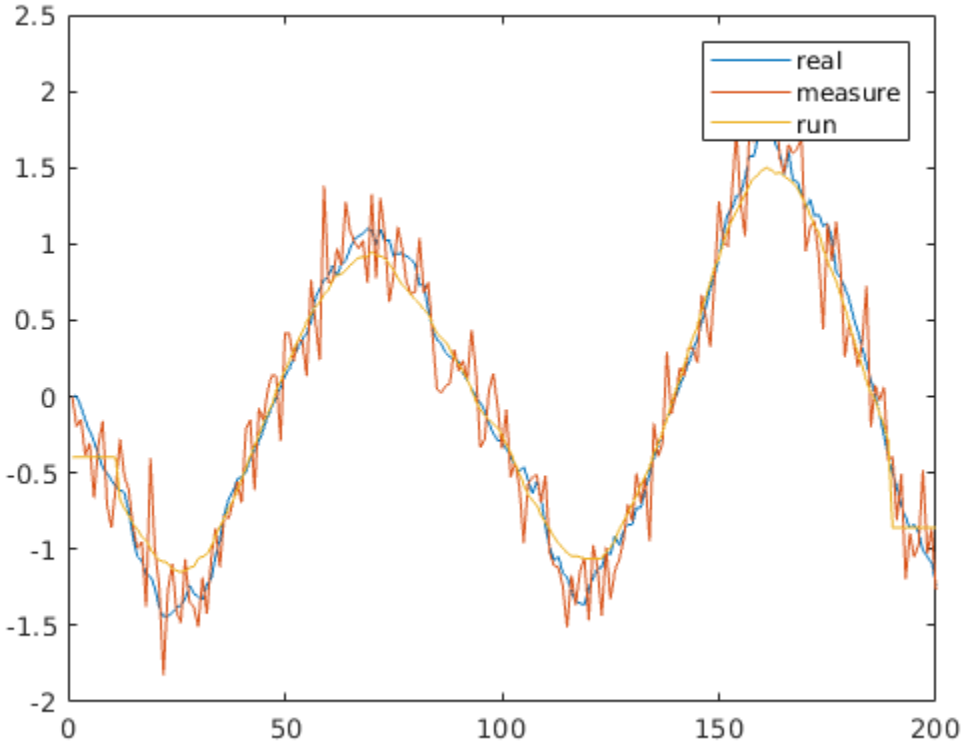
compare period of oscilations and size of smoothing window

```
close all
N = 200;
x = zeros(1,N);
z = zeros(1,N);
A = zeros(1,N);
sigmaW = 0.08;
sigmaN = sqrt(0.05);
% for group 5
M = 23;

% inverse oscilations
T = M/1.5;
[ r, x, z ] = runfromperiod(T, sigmaW, sigmaN, M);
t = 1:N;
figure(1)
plot(t,x, t,z, t,r);
legend('real', 'measure', 'run');

% loss of oscilations
T = M;
[ r, x, z ] = runfromperiod(T, sigmaW, sigmaN, M);
figure(2)
plot(t,x, t,z, t,r);
legend('real', 'measure', 'run');
```

```
% insignificant changes
T = 4*M;
[ r, x, z ] = runfromperiod(T, sigmaW, sigmaN, M);
figure(3)
plot(t,x, t,z, t,r);
legend('real', 'measure', 'run');
```




real
measure
run
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0
50
100
150
200


real
measure
run
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
50
100
150
200

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