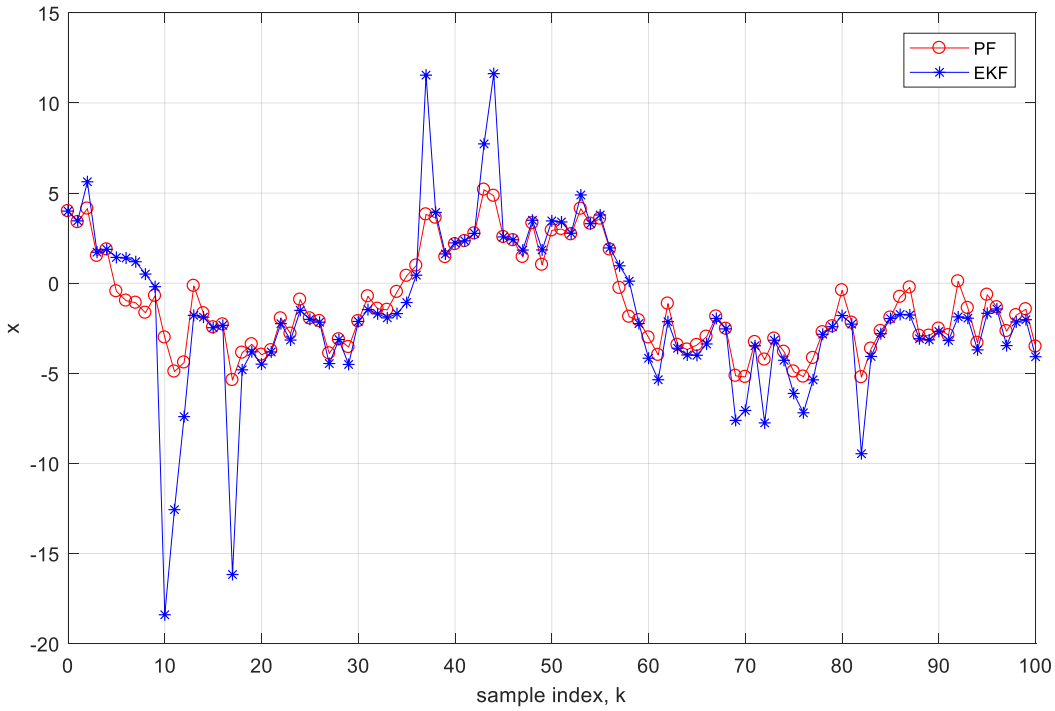
Assignment 8 Problem 4



Code, Prob 3

```
clc; clear; close all;
```

Initialization

```
load('measdata_pfexample');

x_hat_0 = xhat0; P_0 = P0;

nx = 1;
nz = 1;
N = 101;
Ns = 1e7;

x_hat = zeros(nx,N);
P = zeros(nx,N);

x_hat(1) = x_hat_0;
P(1) = P_0;
```

```
x_math_0 = x_hat_0 + randn(Ns,1)*sqrt(P_0);

x_math_k = x_math_0;


W_k = ones(Ns,1)/Ns;
```

Particle Filter

```
for kk = 1:N-1

    x_math_kp1 = 2*atan(x_math_k) + 0.5*cos(pi*kk/3) + randn(Ns,1)*sqrt(Q);

    z_hat_kp1 = x_math_kp1 + x_math_kp1.^2 + x_math_kp1.^3;

    expo_temp = (zkhist(kk,1)*ones(Ns,1) - z_hat_kp1).^2/R/2;

    log_wk_m_expo = log(W_k) - expo_temp;

    [~,imax] = max(log_wk_m_expo);

    W_til_kp1 = exp(log_wk_m_expo - log_wk_m_expo(imax));

    W_kp1 = W_til_kp1./sum(W_til_kp1);

    x_hat(kk+1) = x_math_kp1'*W_kp1;


    del_x_kp1 = x_math_kp1-x_hat(kk+1);

    P(kk+1) = (del_x_kp1.^2)'*W_kp1;

    c = zeros(1,Ns+1);


    % Resamp, a version first approach

    [eta,indv] = sort(rand(1,Ns));

    nn = 1;
    x_temp = zeros(1,Ns);

    for ii = 1:Ns

        flag = 1;
        while flag && nn<=Ns

            if eta(nn) >= c(ii) && eta(nn) < c(ii+1)

                x_temp(indv(nn))=x_math_kp1(ii);
                nn = nn +1;
```

```
                flag = 1;
            else

                flag = 0;
            end
        end

    end




    Bool1 = eta>=c(1:end-1);
    Bool2 = eta<c(2:end);
    Bool = (Bool1.*Bool2);


    % reset
    x_math_k = x_temp';
    W_k = ones(Ns,1)/Ns;
    kk
end

figure(1);
plot([0:100],x_hat,'--r');grid on;hold on;
ylabel('x')
xlabel('sample index, k')
% ylim([-5 5])
```

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Code, Prob 4

```
clc; clear; %close all;
```

Initialization

```
load('measdata_pfexample');

x_hat_0 = xhat0; P_0 = P0;

nx = 1;
nz = 1;
N = 101;

x_hat = zeros(nx,N);
P = zeros(nx,N);

x_hat(1) = x_hat_0;
P(1) = P_0;

Gamma = 1
```

EKF

```
for kk = 1:N-1

    x_bar_kp1 = 2*atan(x_hat(kk)) + 0.5*cos(pi*kk/3);
    F_k = 2  /(1 + x_hat(kk)^2 );

    P_bar_kp1 = F_k^2*P(kk) + Q;

    z_bar_kp1 = x_bar_kp1 + x_bar_kp1^2 + x_bar_kp1^3;

    H_kp1 = 1 + 2*x_bar_kp1 + 3*x_bar_kp1^2;

    nu_kp1 = zkhist(kk) - z_bar_kp1;

    s_kp1 = H_kp1^2*P_bar_kp1+R;
    w_kp1 = P_bar_kp1*H_kp1/s_kp1;

    x_hat(kk+1) = x_bar_kp1 + w_kp1*nu_kp1;
    P(kk+1) = P_bar_kp1 - w_kp1^2*s_kp1;

end

figure(1);
plot([0:100],x_hat,'-b');grid on;hold on;
ylabel('x')
```

```
xlabel('sample index, k')
% ylim([-5 5])
```

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