Lecture 4: Discrete Kalman filter - first taste

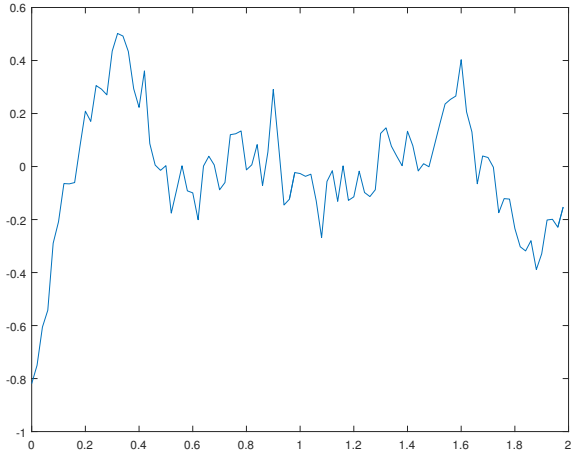
Matlab Example

- system model (sampling period = 0.02 sec)

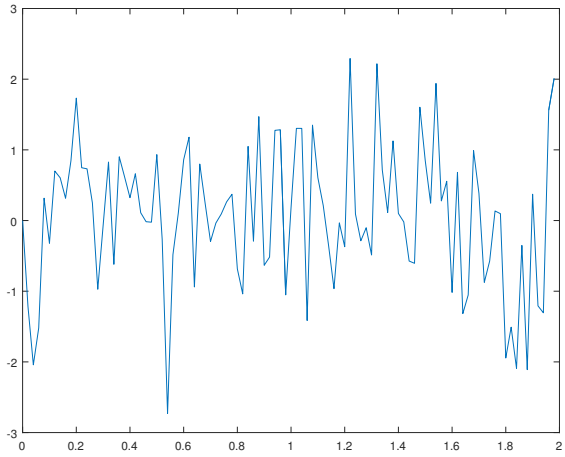
$$\begin{aligned} x(k+1) &= Ax(k) + w(k) \\ z(k) &= Hx(k) + v(k) \end{aligned}$$

  where $A = 0.8$, $H = 1$, $Q = 0.01$, $R = 1$
- initial estimation: $\hat{x}_0^- = 0$ and $P_0^- = 1$

```
A = 0.9;
H = 1;
T = 0.02;
N = 100;
Q = 0.03;
R = 1;
P0 = 1;

tt = 0:T:T*(N-1);

w = sqrtm(Q) * randn(N,1);
v = sqrtm(R) * randn(N,1);

x = zeros(N,1);
z = zeros(N,1);

x(1) = sqrtm(P0)*randn;
for i = 2:N
    x(i) = A*x(i-1) + w(i-1);
    z(i) = H*x(i) + v(i);
end
```

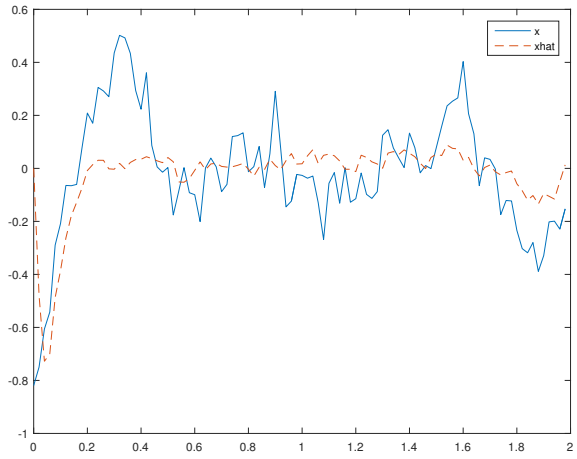


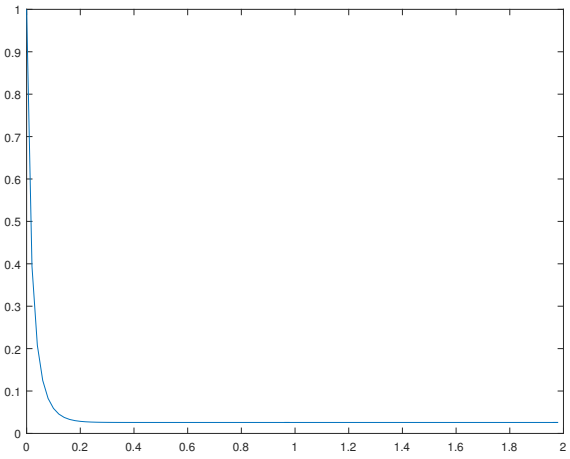
$x(t)$



$z(t)$

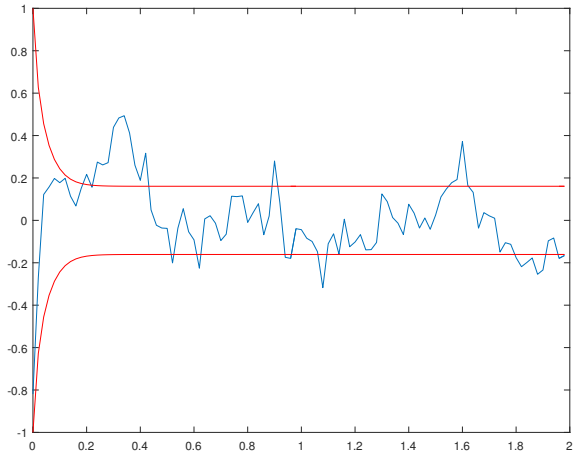
- $\hat{x}$ from the Kalman filter and $P(k)$

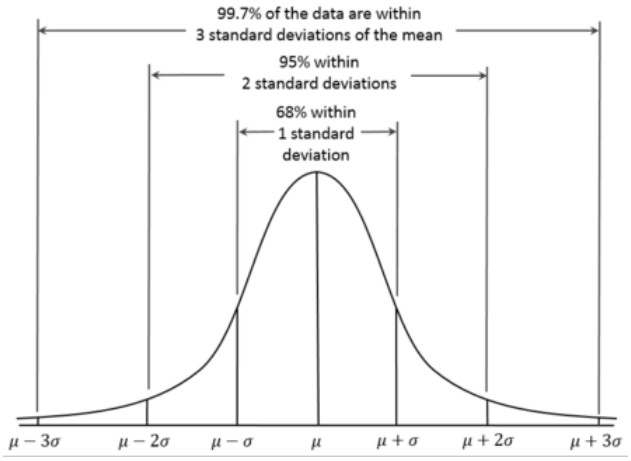




(figure 1)

- $e(k)$ and $\sqrt{P(k)}$ (note that $e(k) = x(k) - \hat{x}(k)$)





(figure 2)

Homework

(1) Write a matlab code to compute the Kalman filter and draw the above figures (figure 1 and 2).