4.5

```
disp([mean(mu),rho,limit95,muk]);
q_nom =

    0.1000

   -0.0049    0.3351    0.0877    1.0000


q_nom =

    0.5000

   -0.0026    0.1714    0.0877    1.0000


q_nom =

     1

   -0.0019    0.1168    0.0877    1.0000


q_nom =

    10

   -0.0006    0.0365    0.0877    1.0000


q_nom =

    20

   -0.0004    0.0268    0.0877    1.0000


q_nom =

   100

   -0.0002    0.0065    0.0877    1.0000
```

q_nom =

1000

-0.0000   0.0300   0.0877   1.0000

q_nom =

10000

0.0000   0.0976   0.0877   1.0000

q_nom =

100000

0.0000   0.2153   0.0877   1.0000

Monte-Carlo

disp([mean(mu_k),muk1,rhot1]);

q_nom =

0.1000

0.0000   1.0000   1.0000

q_nom =

0.5000

0.0000   1.0000   1.0000

q_nom =

```
     1

    0.0000    1.0000    1.0000

q_nom =

    10

    0.0000    1.0000    1.0000

q_nom =

    20

    0.0000    1.0000    1.0000

q_nom =

   100

    0.0000    1.0000    1.0000

q_nom =

        1000

    0.0000    1.0000    1.0000

q_nom =

       10000

    0.0000    1.0000    1.0000

q_nom =

      100000
```

0.0000 1.0000 1.0000

Some Vars I need to point out

The muk ,muk1,rhot1 are the percentage that in the range we set.

The **rho, e_time** and **mu** are the consistency test that for single run process

The **rho_t, E_t** and **mu_t** are the consistency test that for multiple run process applied Monte-Carlo expectation.

Epsilon is the average error we in NES test

As we can see although the epsilon/e_time are going smaller when we increase the q . the rho/rho_t does not perform the same. It’s (norm) reach the lowest when we touch the optimal q which is the closest q to the real q.

Because of the big amount of the data, U can check the data in the workspace.

The 2 main exe are example4_2.m and Monte_Carlo.m

4.10. Let's def Residual eqn.

$$e_k^- = y_k - H\hat{x}_k^-$$

$$= -H x_k^- + v_k \qquad \because x_k^- = \hat{x}^- - x_k$$

$$C_i = E\{e_k^- e_{k-i}^{-T}\}$$

$$= E\{[-Hx_k^- + v_k][-Hx_{k-i}^- + v_{k-i}]^T\}$$

$$= H E\{x_k^- x_{k-i}^{-T}\} H^T - H E\{x_k^- v_{k-i}^T\} + E\{v_k v_{k-i}^T\}$$

if $i > 0$

$$C_i = H E\{x_k^- x_{k-i}^{-T}\} H^T - H E\{x_k^- v_{k-i}^T\}$$

However

if. $i = 0$.

$$C_i = HPH^T + R.$$

$$\Rightarrow x_k^- = \Phi(I-KH)x_{k-1}^- + \Phi K v_{k-1} - V w_{k-1}$$

$$= [\Phi(I-KH)]^i x_{k-i}^- + \sum_{j=1}^{i}[\Phi(I-KH)]^{j-1}\Phi K v_{k-j} - \sum_{j=1}^{i}[\Phi(I-KH)]^{j-1} w_{k-j}$$

$$\Rightarrow E\{x_k^- x_{k-i}^{-T}\} = \Phi(I-KH)^i P.$$

$$E\{x_k^- v_{k-i}^T\} = \Phi(I-KH)^{i-1}\Phi K R.$$

$\because C_0 = HPH^T + R \Rightarrow R = C_0 - HPH^T$

$\because i > 0.$

$C_i = H[\Phi(I-KH)]^{i-1}\Phi(I-KH)PH^T - H[\Phi(I-KH)]^{i-1}\Phi KR$

$= H[\Phi(I-KH)]^{i-1}\Phi\{(I-KH)PH^T - K(C_0 - HPH^T)\}.$

$= H(\Phi(I-KH))^{i-1}\Phi\{PH^T - KC_0\}$

$= H[\Phi(I-KH)]^{i-1}\Phi[PH^T - KC_0].$

$\Rightarrow C_i = \begin{cases} H\Phi(I-KH)^{i-1}\Phi[PH^T - KC_0] & i > 0 \\ HPH^T + R & i = 0 \end{cases}$ proved ∎