x

y

$\dot{x}$

$\dot{y}$

$$x_k = f(x_{k-1}, u_{k-1}) + v_{k-1}$$

$$z_k = h(x_k) + w_k$$

f

h

w

z

u

x_k

z_k

$\hat{x}_k$

$\hat{z}_k$

$$y = \begin{bmatrix} f_1(x_1, x_2, x_3) \\ f_2(x_1, x_2, x_3) \end{bmatrix}$$

$$Jac(y) = \begin{bmatrix} \frac{\partial f_1}{\partial x_1} & \frac{\partial f_1}{\partial x_2} & \frac{\partial f_1}{\partial x_3} \\ \frac{\partial f_2}{\partial x_1} & \frac{\partial f_2}{\partial x_2} & \frac{\partial f_2}{\partial x_3} \end{bmatrix}$$

$$Hess(y(1)) = \begin{bmatrix} \frac{\partial^2 f_1}{\partial x_1^2} & \frac{\partial^2 f_1}{\partial x_1 \partial x_2} & \frac{\partial^2 f_1}{\partial x_1 \partial x_3} \\ \frac{\partial^2 f_1}{\partial x_2 \partial x_1} & \frac{\partial^2 f_1}{\partial x_2^2} & \frac{\partial^2 f_1}{\partial x_2 \partial x_3} \\ \frac{\partial^2 f_1}{\partial x_3 \partial x_1} & \frac{\partial^2 f_1}{\partial x_3 \partial x_2} & \frac{\partial^2 f_1}{\partial x_3^2} \end{bmatrix}$$

$$Hess(y(2)) = \begin{bmatrix} \frac{\partial^2 f_2}{\partial x_1^2} & \frac{\partial^2 f_2}{\partial x_1 \partial x_2} & \frac{\partial^2 f_2}{\partial x_1 \partial x_3} \\ \frac{\partial^2 f_2}{\partial x_2 \partial x_1} & \frac{\partial^2 f_2}{\partial x_2^2} & \frac{\partial^2 f_2}{\partial x_2 \partial x_3} \\ \frac{\partial^2 f_2}{\partial x_3 \partial x_1} & \frac{\partial^2 f_2}{\partial x_3 \partial x_2} & \frac{\partial^2 f_2}{\partial x_3^2} \end{bmatrix}$$

$$x_k = Ax_{k-1} + Bu_{k-1} + v_{k-1}$$

$$z_k = Hx_k + w_k$$

A

B

H

$Q = Q^T$

$$R = R^T$$

$x_k = 12 + v_{k-1}$

$$z_k = x_k + w$$

$A = 0$

$B = 1$

$H = 1$

$u = 12$

$x_0 = 12$

$Q = 4$

$R = 4$

Q

R

$$f = \begin{bmatrix} \sin(x_2(k-1))(k-1) \\ x_2(k-1) \end{bmatrix}$$

$$h = \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix}$$

$$x_0 = \begin{bmatrix} 0 \\ \frac{1\pi}{500} \end{bmatrix}$$

$$f = \begin{bmatrix} x_2(k) \\ x_3(k) \\ 0.005\, x_1(k) \left(x_2(k) + x_3(k) \right) \end{bmatrix}$$

$$h = \left[x_1(k)\right]$$

$$x_0 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

x_1

x_2

x_3

u_k

$$x_k = x_{k-1} + v_{k-1}$$