Q39

Note Title 9/21/2014

Prob 1.30 (f, g, j, n)

① $y[n] = x[n]\,x[n-1]$ invertible?

Ans: $x_1[n] = 0$ for all n.

$$x_2[n] = \begin{cases} 0 & \text{for all even } n \\ 1 & \text{for all odd } n \end{cases}$$

$x_1[n] \longrightarrow y_1[n] = 0$ for all n

$x_2[n] \longrightarrow y_2[n] = 0$ for all n

$\Rightarrow$ Not invertible.

② $y[n] = x[1-n]$ Invertible?

Ans: $x[k] = y[1-k]$ $k = 1-n$, $n = 1-k$

$\Rightarrow$ invertible.

③ $y(t) = \frac{d}{dt}x(t)$ invertible?

Ans: $x_1(t) = 0$, $x_2(t) = 1$.

$x_1(t) \longrightarrow y_1(t) = 0$

$x_2(t) \longrightarrow y_2(t) = 0$

$\Rightarrow$ Not invertible.

④ $y[n] = \begin{cases} x[n/2] & \text{if } n \text{ is even} \\ 0 & n \text{ is odd} \end{cases}$ invertible?

Ans: $x[k] = y[2k]$

$\Rightarrow$ invertible.

* Question for the teams

Consider a sliding window averaging system

$$y[n] = \begin{cases} \dfrac{1}{\min(5,n)+1} \displaystyle\sum_{k=\max(0,n-5)}^{n} x[k] & \text{if } n > 0 \\ x[n] & n \le 0. \end{cases}$$

Ans: The inverse system is

$$x[n] = \begin{cases} y[n] & \text{if } n \le 0 \\ (n+1)y[n] - n\,y[n-1] & \text{if } 1 \le n \le 5 \\ 6y[n] - 6y[n-1] + x[n-6] & \text{if } 6 \le n. \end{cases}$$