Exp 1

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1> $y(t) = 3x(t) + \int_{-\infty}^{t} x(\tau)d\tau$

a) Linear

b) Time Invariant

c) let $x(t) = u(t) \rightarrow$ Bounded i/p

$$y(t) = 3u(t) + \int_{-\infty}^{t} u(\tau)d\tau = \underbrace{3u(t) + r(t)}_{\text{Unbounded o/p}}$$

BIBO not followed.

$\Rightarrow$ Unstable

2> $y[n] = 2x[n] - x[n-1] + \frac{1}{2}y[n-1]$

a) Linear

b) Time Invariant

c) Stable for a finite $x[n]$, we get a finite $y[n]$

BIBO followed.

Exp2

a) $y(t) = 3x(t) + \int_{-\infty}^{t} x(\tau)\,d\tau$

let $x(t) = \delta(t)$

$y(t) = h(t) = 3\delta(t) + u(t)$

b) $y[n] = 2x[n] - x[n-1] + \frac{1}{2}y[n-1]$

~~let $x[n] = \delta[n]$~~

$\cancel{h[n] = 2\delta[n] - \delta[n-1] + \frac{1}{2}h[n-1]}$

$\cancel{h[n] - \frac{1}{2}h[n-1] = 2\delta[n] - \delta[n-1]}$

$y[n] - \frac{1}{2}y[n-1] = 2x[n] - x[n-1]$

Taking DTFT

$(1 - \tfrac{1}{2}e^{-j\omega})\,Y(e^{j\omega}) = (2 + e^{-j\omega})X(e^{j\omega})$

$$H(e^{j\omega}) = \frac{Y(e^{j\omega})}{X(e^{j\omega})} = \frac{2 + e^{-j\omega}}{1 - 0.5e^{-j\omega}}$$

Taking Inverse DTFT

$h[n] = 2(0.5)^n u[n] + (0.5)^{n-1} u[n-1]$

Exp 3

1) $x(t) = e^{-2t} u(t)$

$h(t) = \delta(t-1)$

$y(t) = x(t) * h(t)$

$y(t) = x(t) * h(t)$

$= x(t) * \delta(t-1)$ // shifting property

$= x(t-1)$

$y(t) = e^{-2(t-1)} u(t-1)$

Experiment 3 Convolution

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2) $x[n] = \{1, 2, 1\}$

$h[n] = \{1/2, 1, -1/2\}$

$y[n] = x[n] * h[n]$

0.5 2 2 0 -0.5

$$y[n] = \sum_{k=-\infty}^{\infty} x[k] \cdot h[n-k]$$

| h(n) \ x(n) | 1 | 2 | 1 |
|---|---|---|---|
| 1/2 | 1/2 | 1 | 1/2 |
| 1 | 1 | 2 | 1 |
| -1/2 | -1/2 | -1 | -1/2 |

$y[n] = \{+1/2, 2, 2, 0, -1/2\}$

$= \{1/2, 2, 0, -1/2\}$