(1.3) $T_1\{x[n]\} = 2x[n]$, $T_2\{x[n]\} = x[n-1]$

1. $y[n] = T_1\{x[n]\} + T_2\{x[n]\} =$
2. $= 2x[n] + x[n-1]$
3. $y[n] = 2\delta[n] + \delta[n-1]$

(1.5) $y(t) = 3x(t) - x(t-2)$

1. det
2. SISO
3. dynamic
4. $y(t_0) = 3x(t_0) - x(t_0-2)$ $\quad t \le t_0$

$\Rightarrow$ αιτιατό

5. $T\{\alpha x_1 + b x_2\}(t) =$

$= 3(\alpha x_1(t) + b x_2(t)) - (\alpha x_1(t-2) + b x_2(t-2))$

$= \alpha(3x_1(t) - x_1(t-2)) + b(3x_2(t) - x_2(t-2))$

$= \alpha T\{x_1\}(t) + b T\{x_2\}(t)$

$\rightarrow$ linear

6. $x_s(t) = x(t-t_0)$

$T\{x_s\}(t) = 3x(t-t_0) - x(t-t_0-2)$

$\Rightarrow y(t-t_0) = 3x(t-t_0) - x(t-t_0-2)$

$T\{x(t-t_0)\}(t) = y(t-t_0)$

χρ. αμετ. / time inv.

(1.15) $y[n] = 2x[n] + 1$

1. det
2. SISO
3. memoryless
4. αιτιατό (causal)
5. $T\{\alpha x[n]\} = 2\alpha x[n] + 1$

$\alpha T\{x[n]\} = \alpha(2x[n]+1) = 2\alpha x[n] + \alpha$

$T\{\alpha x[n]\} \neq \alpha T\{x[n]\}$

$T\{0\} = 1 \neq 0$, $\alpha = 0$

μη γραμμικό

6. $x_s[n] = x[n-n_0]$

$\Rightarrow T\{x_s\}[n] = 2x[n-n_0] + 1$

$y[n-n_0] = 2x[n-n_0] + 1$ $\quad (=)$

χρ. αμετ.

(1.17) $y[n] - 0.5y[n-1] = x[n] + 2x[n-1]$

1) $y[n-1] \rightarrow$ συστημα 1ης τάξης
2) γραμμικό, ~~(×)~~ $x[n]y[n-1]$
~~(×)~~ $(y[n])^2$
3) $n y[n] \rightarrow$ χρ. αμετ.
4) $y[n]$ εξαρτάται από $x[n-1]$, $y[n-1]$

$-$μνήμη

5) αιτιατό

$y[n+1] - 0.5y[n] = x[n+1] + 2x[n]$

$y[n+1]$

$y[n+2]$

$y[n+1] - x[n]$

$n+100$ $\quad n+99$

(1.18) $y(t) = 3x(t)$

$|x(t)| \le M_x$, $\forall t$, $M_x < \infty$

$|y(t)| = |3x(t)| = |x(t)| \le M_x$

$\Rightarrow y(t) \le 3M_x$, $\forall t$ 3

$\Rightarrow y(t) \le M_y \Rightarrow M_y = 3M_x$, $M_y < \infty$, $\forall t$

(1.19) $y(t) = t \cdot x(t)$ / $y(t) = 3x(t)$

$x(t) = 1 \leftarrow$ ch.

$t_1 = 1 \rightarrow y(t_1) = 1$

$t_2 = 10 \rightarrow y(t_2) = 10$

$t \rightarrow \infty \rightarrow y(t_\infty) \rightarrow \infty$

(1.22) $\frac{dy(t)}{dt} + y(t) = x(t)$,

$x(t) = 0$, $y(0) = 3$

1. $\frac{dy(t)}{dt} + y(t) = 0 \Rightarrow \frac{dy(t)}{dt} = -y(t)$

$y(t) = Ae^{-t} \xrightarrow{y(0)=3} y(0) = Ae^0 \Rightarrow A = 3$

$\Rightarrow \boxed{y_{ZI}(t) = 3e^{-t}}$

2. $y(0) = 0$, $x(t) = 0$

$y_{ZS}(t) = 0$

3. $TR = ZI + ZS$

$\Rightarrow y(t) = y_{ZI}(t) + y_{ZS}(t) = 3e^{-t} + 0 = 3e^{-t}$