FACULDADE ENGENHARIA

Signals Analysis – Homework 06 (z-Transforms)

1) – Solve the **difference equations** below:

a)

$y[n] - 2 \cdot y[n-1] = x[n] + 4 \cdot x[n-1]$; $x[n] = u_o[n]$ (discrete unit impulse), and zero initial condition, that is: $y[-1] = 0$.

Solution: $y[n] = 2^n \cdot u_1[n] + 4 \cdot 2^{n-1} \cdot u_1[n-1]$

b)

$y[n] + 3 \cdot y[n-1] = x[n]$; $x[n] = 4 \cdot u_1[n]$ (discrete step), and initial condition: $y[-1] = 1$.

Solution: $y[n] = u_1[n+1]$

c)

$y[n] - 2 \cdot y[n-1] = x[n] + 4 \cdot x[n-1]$; $x[n] = u_1[n]$ (discrete unit step), and zero initial condition, that is: $y[-1] = 0$.

d)

$y[n] - (1/6) \cdot y[n-1] - (1/6) \cdot y[n-2] = x[n]$; $x[n] = u_o[n]$ (discrete unit impulse), and zero initial condition, that is: $y[-1] = 0$ and $y[-2] = 0$.

e)

$y[n] - (1/6) \cdot y[n-1] - (1/6) \cdot y[n-2] = x[n]$; $x[n] = u_1[n]$ (discrete unit step), and zero initial condition, that is: $y[-1] = 0$ and $y[-2] = 0$.

f)

$y[n] - (1/6) \cdot y[n-1] - (1/6) \cdot y[n-2] = x[n]$; $x[n] = u_1[n]$ (discrete unit step), and initial condition: $y[-1] = 1$ and $y[-2] = 0$.

g)

$y[n] - 2 \cdot y[n-1] + 17 \cdot y[n-2] = x[n]$; $x[n] = u_o[n]$ (discrete unit impulse), and zero initial condition, that is: $y[-1] = 0$ and $y[-2] = 0$.

h)

$y[n] - 2 \cdot y[n-1] + 17 \cdot y[n-2] = x[n]$; $x[n] = u_1[n]$ (discrete unit step), and zero initial condition, that is: $y[-1] = 0$ and $y[-2] = 1$.

i)

$y[n] + 10 \cdot y[n-1] + 25 \cdot y[n-2] = x[n]$; $x[n] = u_o[n]$ (discrete unit impulse), and zero initial condition, that is: $y[-1] = 0$ and $y[-2] = 0$.

j)

$y[n] + 10 \cdot y[n-1] + 25 \cdot y[n-2] = x[n]$; $x[n] = u_1[n]$ (discrete unit step), and zero initial condition, that is: $y[-1] = 0$ e $y[-2] = 0$.

k)

$y[n] + 10 \cdot y[n-1] + 25 \cdot y[n-2] = x[n]$; $x[n] = u_1[n]$ (discrete unit step), and initial condition: $y[-1] = 1$ and $y[-2] = 1$.

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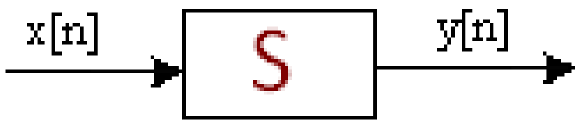
(z-Transforms)
continued

2) – For the solutions found in **exercise 1** above apply the **theorems IVT** (Initial Value Theorem) and **FVT** (Final Value Theorem) for the **discrete signals** that are possible to apply and verify if they check.

3) – Given the **impulse response** $h[n]$ and the input $x[n]$ of a **LTI system**, find $H(z)$ and the output $y[n]$:



a) $h[n] = (1/2)^n \cdot u_1[n]$, $x[n] = 2u_1[n]$ (discrete step).

b) $h[n] = [(0{,}6)\cdot(-2)^n + (0{,}4)\cdot(-3)^n]\cdot u_1[n]$, $x[n] = u_1[n]$ (discrete unit step).

c) $h[n] = (2)^n \cdot \sin[(n+1)\cdot(\pi/2)\,]\cdot u_1[n]$, $x[n] = u_1[n]$ (discrete unit step).

d) $h[n] = 2\cdot(n+1)\cdot(-1/2)^n \cdot u_1[n]$, $x[n] = u_1[n]$ (discrete unit step).