GATE ASSIGNMENT 4

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Download all python codes from

https://github.com/Ananthoju−Pranav−Sai/EE3900/blob/main/Gate_Assignment_4/codes

and latex-tikz codes from

https://github.com/Ananthoju−Pranav−Sai/EE3900/tree/main/Gate_Assignment_4/Gate_Assignment_4.tex

1 GATE EC 2000 Q.2.31

Let u(t) be the step function. Plot the wave form corresponding to the convolution of u(t)-u(t-1) with u(t)-u(t-1).

2 Solution

We define unit step function as follows

$$u(t) = \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases} \tag{2.0.1}$$

Now let $f(t) = u(t) - u(t-1)$ and $g(t) = u(t) - u(t-2)$ then,

$$f(t) = \begin{cases} 0 & t < 0 \\ 1 & 0 \leq t < 1 \\ 0 & t \geq 1 \end{cases} \tag{2.0.2}$$

$$g(t) = \begin{cases} 0 & t < 0 \\ 1 & 0 \leq t < 2 \\ 0 & t \geq 2 \end{cases} \tag{2.0.3}$$

Let $y(t)$ be convolution of $f(t)$ and $g(t)$ So we have,

$$y(t) = \int_{-\infty}^{\infty} f(\tau) g(t-\tau)\, d\tau \tag{2.0.4}$$

$$\implies y(t) = \int_{0}^{1} g(t-\tau)\, d\tau \tag{2.0.5}$$

(2.0.6)

$$y(t) = \begin{cases} 0 & t < 0 \\ \int_0^t 1\, d\tau & 0 \leq t < 1 \\ \int_0^1 1\, d\tau & 1 \leq t < 2 \\ \int_{t-2}^1 1\, d\tau & 2 \leq t < 3 \\ 0 & t \geq 3 \end{cases} \tag{2.0.7}$$

So we get $y(t)$ as follows

$$y(t) = \begin{cases} 0 & t < 0 \\ t & 0 \leq t < 1 \\ 1 & 1 \leq t < 2 \\ 3 - t & 2 \leq t < 3 \\ 0 & t \geq 3 \end{cases} \tag{2.0.8}$$

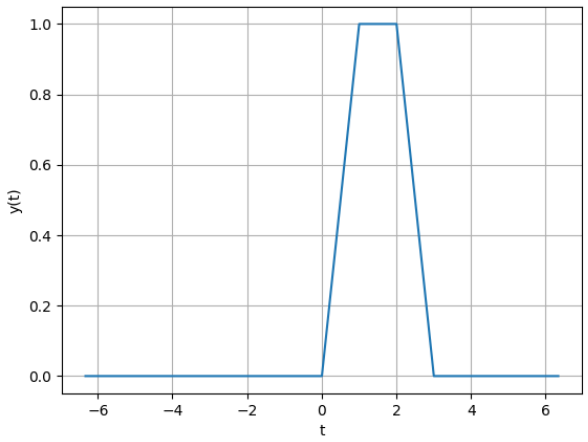

Fig. 0: Simulated plot of output signal y(t)