GATE ASSIGNMENT 1

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Download all python codes from

```
https://github.com/AmulyaTallamraju/EE3900/blob/
    main/GATE_Assignment-2/codes/
    GATE_Assignment-2.py
```

and latex-tikz codes from

```
https://github.com/AmulyaTallamraju/EE3900/blob/
    main/GATE_Assignment-2/
    GATE_Assignment-2.tex
```

1 GATE EC 2005 Q.5

The function $x(t)$ is shown in figure. Even and odd parts of a unit step function u(t) are given by

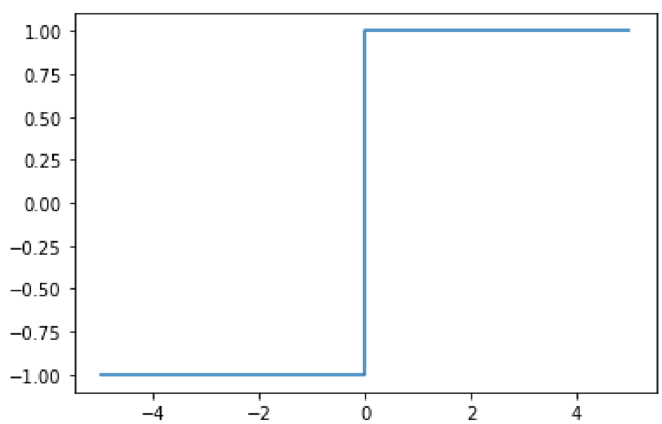

Fig. 0: Plot of $x[t]$

2 Solution

Odd part of $u(t)$ is given by

$$\frac{u(t) - u(-t)}{2} \tag{2.0.1}$$

One observing the plots of $x(t), u(t), -u(-t)$ we can see that

$$x(t) = u(t) - u(-t) \tag{2.0.2}$$

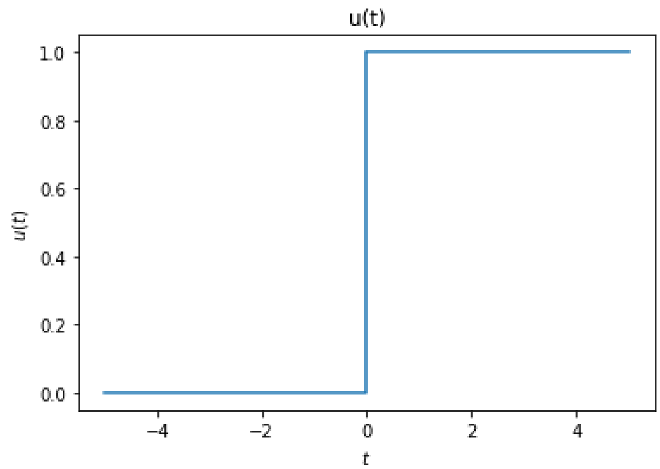

Fig. 0: Plot of $u[t]$

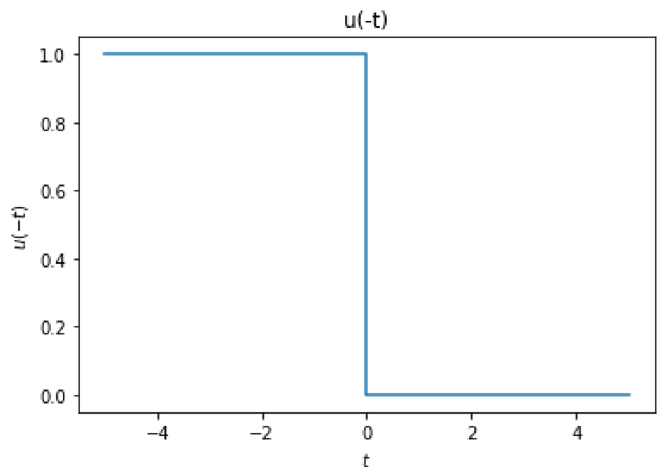

Fig. 0: Plot of $u[t]$

Thus, the odd part of $u(t)$ is $\frac{x(t)}{2}$. The even part of u(t) is given by

$$\frac{u(t) + u(-t)}{2} = \frac{1}{2} \tag{2.0.3}$$

Thus the even and odd parts of the unit step signal are

$$\frac{1}{2}, \frac{x(t)}{2} \tag{2.0.4}$$

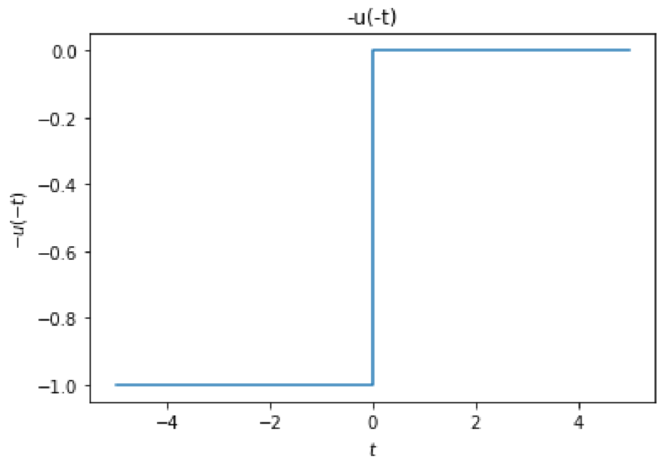

Fig. 0: Plot of $-u[-t]$

The fourier transform of $x(t)$ is given by

$$X(\omega) = \int_{-\infty}^{+\infty} x(t)e^{-j\omega t}dt \tag{2.0.5}$$

This signal is not absolutely integrable so we calculate Fourier Transform of $x(t)$ as a limiting case of the sum of exponential $e^{-at}u(t) - e^{at}u(t)$ as $a \to 0$.

$$X(\omega) = \lim_{a\to 0}\int_{-\infty}^{+\infty} \left(e^{-at}u(t) - e^{at}u(t)\right)e^{-j\omega t}dt \tag{2.0.6}$$

$$= \lim_{a\to 0}\left[\frac{1}{a+j\omega} - \frac{1}{a-j\omega}\right] \tag{2.0.7}$$

$$= \frac{2}{j\omega} \tag{2.0.8}$$

Laplace transform of $x(t)$

$$\mathcal{L}\{x\}(s) = \int_0^\infty x(t)e^{-st}\,dt. \tag{2.0.9}$$

$$= \frac{1}{s} \tag{2.0.10}$$