Istanbul Technical University
Faculty of Computer and Informatics
Computer Engineering Department

BLG 354E
Signals & Systems for Computer Engineering
Homework III

Uğur Uysal - 150140012

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Contents

1 Question I

1.1 Part A

Signal a is not causal because output obviously depends on future and differentiation systems are not stable.

1.2 Part B

Causal system because output depends from past moment t. It is unstable because let input be unit step function and at moment t output goes to infinite.

1.3 Part C

Causal and stable.

1.4 Part D

Causal and stable.

2 Question II

Convolution integral is $y(t) = \int_{\infty}^{-\infty} x(t-\tau)h(\tau)d\tau$ and we must compute it for every t.

$$y(t) = 0 \text{ when } t-2 < 3, \quad t \geq 5 \quad y(t) = \int_{3}^{t-2} 5e^{-0.5(\tau-3)}[u(\tau-3) - u(\tau-11)]d\tau$$

Some fancy math here.

3 Question III

Not answered.

4 Question IV

I did not write any code for this question but from lesson I remember after convolutions graphic shape become more like uniform distribution. From low variance normal distribution to high variance normal distribution. After that I searched online what it looks like and I see my thoughts are true.

5 Question V

5.1 Part A

$$H(jw) = \int_{\infty}^{-\infty} h(t)e^{-jwt}dt$$

$$= H(jw) = \int \delta(t-2)e^{-jwt}dt + \int -0.2e^{-0.2(t-2)}e^{-jwt}$$

$$= e^{-2jw} - 0.2e^{0.4}\int_{2}^{\infty} e^{(-0.2jw)t}dt$$

$$= e^{-2jw} + 0.2e^{0.4}\frac{e^{-0.4+2jw}}{-(0.2+jw)}$$

$$= e^{-2jw} - \frac{0.2e^{-2jw}}{0.2+jw}$$

$$= \frac{jwe^{-2jw}}{0.2+jw}$$

5.2 Part B

5.3 Part C

$$x_1(t) = 5, \quad x_2(t) = 100cos(0.2t), \quad x_3(t) = u(t)$$

$$y_1(t) = H(j0) = 0$$

$$y_2(t) = 10\frac{e^{-0.4j}}{\sqrt{2}}cos(0.2t + \frac{\pi}{4})$$

$$y_3(t) = u(t) * h(t) = u(t-2) + \int_{2}^{\infty} -0.2e^{-0.2(t-2)}u(t-2)u(\tau - t)dt$$

$$= u(t-2) - 0.2e^{0.4}u(t-2)(t-2)$$

$$= u(t-2)[1 - 0.2e^{0.4}(t-2)]$$

$$y(t) = 10\frac{e^{-0.4j}}{\sqrt{2}}cos(0.2t + \frac{\pi}{4}) + u(t-2)[1 - 0.2e^{0.4}(t-2)]$$

6 Question VI

7 Question VII

Attached to mail.