Fundamentals of Signal Processing and Data Analysis Homework 1

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1 What do you want to learn most form this course, and why?

I want to know how to do data processing by using computational methods. During the last semester, while studying mathematical methods in physics, I learned how to use Fourier and Laplace Transform and convolution (continuous integration) to solve the ordinary and partial differential equations. However, I am still unsure how to apply these methods to discrete problems. I especially hope I can learn some practical methods which I haven't learned such as noise processing, machine learning, and other AI technology.

2 What are Elementary DT Signals?

2.1 Unit Step Signal

$$u[n] = \begin{cases} 0 & \text{if } n < 0 \\ 1 & \text{if } n \geq 0 \end{cases} \tag{1}$$

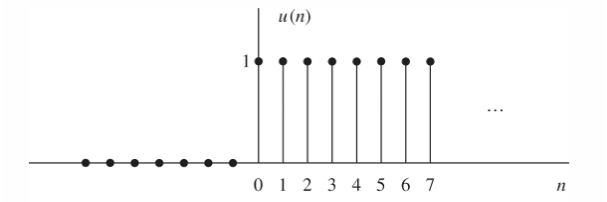

Figure 1: Unit Step Signal

2.2 Unit Ramp Signal

$$u_r[n] = \begin{cases} 0 & \text{if } n < 0 \\ n & \text{if } n \geq 0 \end{cases} \tag{2}$$

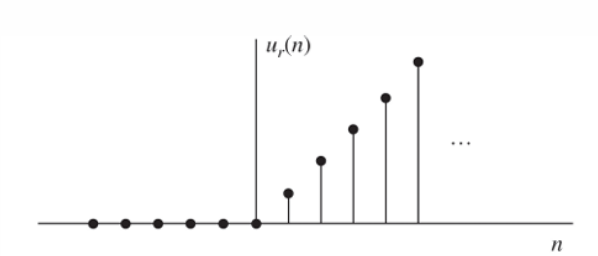

Figure 2: Unit Ramp Signal

2.3 Real Exponential Signal

$$x[n] = a^n \quad \forall n \in \mathbb{Z}, a \in \mathbb{R} \tag{3}$$

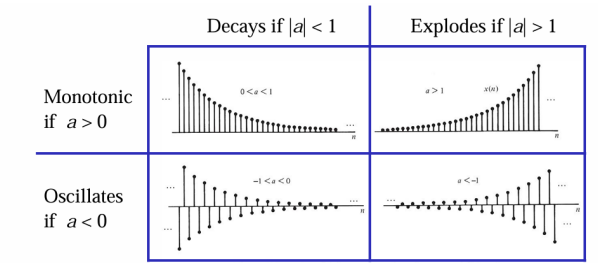

Figure 3: Real Exponential Signal

2.4 Complex Exponential Signal

$$x[n] = a^n \quad \forall n \in \mathbb{Z}, a \in \mathbb{C} \tag{4}$$

2.5 Impulse Response Signal

$$\delta[n] = \begin{cases} 1 & \text{if } n = 0 \\ 0 & \text{if } n \neq 0 \end{cases} \tag{5}$$

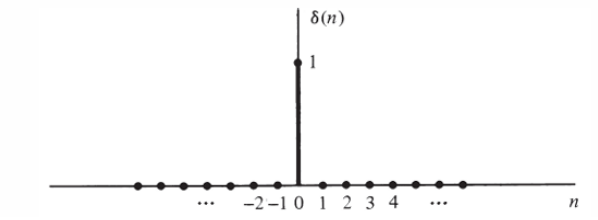

Figure 4: Impluse Response Signal