EE4-45:
Wavelets And Applications

Coursework

Name: Meng Kiang SEAH
CID: 00699092

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1. Random Signals & Stochastic Processes

1.1 Statistical Estimation

1.1.1 Uniform Random Variable

The uniform random variable (RV) is $X \sim U(0,1)$, and has a probability density function (PDF):

$$f_X(x) = \begin{cases} 1 & 0 \leq t \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

The expected value of X, or *theoretical mean* (m) and the standard deviation (σ) are given by Equation 1.1 and 1.2 respectively [1].

$$\begin{aligned} m &= \mathbb{E}[X] \\ &= \int_{-\infty}^{+\infty} x f_X(x)\,dx \\ &= \int_0^1 x\,dx \\ &= \left[\frac{x^2}{2}\right]_0^1 \\ &= \frac{1}{2} \end{aligned} \tag{1.1}$$

$$\begin{aligned} \sigma &= \sqrt{E[X^2] - (E[X])^2} \\ E[X^2] &= \int_{-\infty}^{+\infty} x^2 f_X(x)\,dx \\ &= \int_0^1 x^2\,dx \\ &= \left[\frac{x^3}{3}\right]_0^1 \\ &= \frac{1}{3} \end{aligned}$$

$$\begin{aligned} (E[X])^2 &= \left(\frac{1}{2}\right)^2 \\ &= \frac{1}{4} \\ \sqrt{E[X^2] - (E[X])^2} &= \sqrt{\frac{1}{3} - \frac{1}{4}} \\ &= \sqrt{\frac{1}{12}} \\ &\approx 0.2887 \end{aligned} \tag{1.2}$$

Using the `rand`.

7. References

[1] M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEEtran/