SE Course: Stochastic Analysis for Engineers

MM1: Responses of Linear Time-Invariant Systems to Random Inputs

September 2, 2005

1 Reading

Chapt 4, pp.216-242 of K. Sam Shanmugan and BArthur M. reipohl: "Random Signals - Detection, Estimation and Data Analysis ", John Wiley Sons, Inc., 1988.

2 Content

- Review what we learned in Stochastic Processes in Semester 6;
- Responses of discrete-time LTI systems to random inputs;
- Responses of continuous-time LTI systems to random inputs;

3 Exercise

1. The output of a discrete-time system is related to the input by

$$Y(n) = X(n) - X(n-1)$$

   (a) Find out the impulse response sequence $h(n)$ of this system;
   (b) Calculate the autocorrelation of this $h(n)$ sequence;
   (c) Find out the transfer function $H(f)$ (in Fourier Transformation);
   (d) If the input $X(n)$ is a white noise signal, i.e.,

$$E\{X(n)\} = 0$$
$$R_{XX}(k) = \{ \begin{array}{ll} 1, & for k=0 \\ 0, & for k \neq 0 \end{array}$$

   Find out the μ_Y, $S_{YY}(f)$, and $E\{Y^2(n)\}$.

2. Have a look about Bernard Fleury's lecture notes on webpage:

   http://cpk.auc.dk/dicom/E03/StochasticProcesses.htm

3. Prepare your self-study materials and presentation.