28/11/13

B.E. DEGREE END SEMESTER EXAMINATIONS, NOV 2013
ELECTRONICS AND COMMUNICATION ENGINEERING
SEVENTH SEMESTER – (REGULATIONS 2012)
EC 9037 ADVANCED DIGITAL SIGNAL PROCESSING

Time: 3 hr Max. Marks: 100

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1. Given that x(n) is an AR(1) process where $H(z)=\frac{0.75}{1+0.5z^{-1}}$, determine $r_x(0)$ and $r_x(1)$.
2. Define ergodicity.
3. Determine the number of data points required in modified periodogram method with Hamming window for a resolution of 3.988×10^{-3}.
4. Discuss the effect of number of sections and data points in each section on bias and variance in Bartlett method of power spectrum estimation.
5. Design a first order one-step FIR Wiener predictor given $r_x(k)=(1/2)^{|k|}$.
6. Write the Wiener-Hopf equations for noncausal and causal IIR filters.
7. What is the advantage of adaptive filters?
8. Explain the role of μ in determining the speed of convergence in adaptive filters.
9. What is the difference between fourier and wavelet basis functions?
10. What is MRA equation and its interpretation?

Part– B (5 x 16 = 80 Marks)

11. (i) Using MRA refinement equation, derive the 1-D DWT filter bank structure. (8)
    (ii) Draw the 2D Forward and Inverse block diagrams for the computation of one-level DWT. (8)

12(a). (i) Show that $r_x(0) \geq |r_x(k)|$. (8)
    (ii) Find the filter that generates a random process x(n) with $P_x(z)=\frac{25-24\cos\omega}{26-10\cos\omega}$ by filtering unit variance white noise. (8)

OR

12(b). Derive Yule-Walker equations for ARMA process.

13(a). Explain Bartlett method of power spectrum estimation and discuss its bias and variance.

OR

13(b). Obtain a third-order all-pole model using Levinson-Durbin recursion given that $r_x(0) = 1$, $r_x(1) = 0.8$, $r_x(2) = 0.5$, $r_x(3) = 0.1$

(PTO)

14(a). (i) Design a second-order FIR wiener filter to estimate d(n) from x(n)=d(n)+v(n) where v(n) is zero mean white noise with unit variance and $r_d(k) = 0.8^{|k|}$. (12)

(ii) Compute the minimum mean square error. (4)

OR

14(b). Design a causal wiener filter, H(z), to estimate d(n) from x(n)=d(n)+v(n) where v(n) is unit variance white noise that is uncorrelated with d(n). The signal d(n) is generated as d(n)=0.8d(n-1) + w(n) where w(n) is white noise with variance =0.36.

15(a). (i) Derive LMS algorithm starting from the first principles. (12)

(ii) Explain the computational complexity of the LMS algorithm. (4)

OR

15(b). Discuss the convergence of LMS algorithm.

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