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Electronics and Communication Engineering Department
DIGITAL SIGNAL PROCESSING (BEC-303)
TUTORIAL - UNIT-IV

1. What are the basic building blocks of realisation structures?

2. What are the advantages of representing digital systems in block diagram form?

3. Compare Direct Form I and Direct Form II realization of IIR filters.

4. Compare direct form I and direct form II realisations of IIR systems.

5. What are the drawbacks of direct form realisation of IIR systems?

6. Explain any two IIR filter realisation methods.

7. Draw the block diagram representation of the direct form I and II realisations of the systems with the following transfer functions.

   (a) $\quad H(z) = \dfrac{0.28z^2 + 0.319z + 0.01}{0.5z^3 + 0.3z^2 + 0.17z - 0.2}$

   (b) $\quad H(z) = \dfrac{6z(z^2 - 4)}{5z^3 - 4.5z^2 + 1.4z - 0.8}$

   (c) $\quad H(z) = \dfrac{z^{-1} - 3z^{-2}}{(10 - z^{-1})(1 + 0.5z^{-1} + 0.5z^{-2})}$

   (d) $\quad H(z) = \dfrac{2 + 3z^{-1} - 8z^{-2} + 4z^{-5}}{2 + 3z^{-1} + 6z^{-3}}$

8. Obtain the cascade and parallel realisation structures for the following signals.

   (a) $\quad y(n) = \dfrac{3}{4}y(n-1) - \dfrac{1}{8}y(n-2) + x(n) + \dfrac{1}{3}x(n-1)$

   (b) $\quad y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$

   (c) $\quad y(n) = \dfrac{1}{2}y(n-1) + \dfrac{1}{4}y(n-2) + x(n) + x(n-1)$

9. Develop the cascade and parallel forms of the following casual IIR transfer functions.

   (a) $\quad H(z) = \dfrac{(3 + 5z^{-1})(0.6 + 3z^{-1})}{(1 - 2z^{-1} + 2z^{-2})(1 - z^{-1})}$

   (b) $\quad H(z) = \dfrac{z(z + \frac{1}{2})(z^2 + \frac{1}{3})}{(z - \frac{1}{2})(z + \frac{1}{2})(z^2 - z + \frac{1}{2})}$

10. Realise the following system functions using a minimum number of multipliers.

   (a) $\quad H(z) = (1 + \dfrac{1}{2}z^{-1} - z^{-2})(1 - \dfrac{1}{4}z^{-1} + z^{-2})$

   (b) $\quad H(z) = 1 + \dfrac{1}{2}z^{-1} + \dfrac{1}{4}z^{-2} + z^{-3}$

11. Sketch the ladder structure for the following system

   (a) $\quad H(z) = \dfrac{2 + 8z^{-1} + 6z^{-2}}{1 + 8z^{-1} + 12z^{-2}}$

   (b) $\quad H(z) = \dfrac{1}{z^{-3} + 2z^{-2} + 2z^{-1} + 1}$

12. Obtain FIR linear-phase and cascade realisations of the system function

$$H(z) = (1 + \frac{1}{2}z^{-1} + z^{-2})(1 + \frac{1}{4}z^{-1} + z^{-2})$$

13. What are the effects of finite word length in digital filters?

14. What are the effects of finite word length in digital filters?

15. What is the need for quantization?

16. Analyze truncation and round-off processes in binary number representations.

17. What is round-off noise in IIR filters?

18. Why is rounding preferred over truncation in realizing digital filters?

19. Explain coefficient quantization.

20. Discuss coefficient quantization in IIR filters.

21. Discuss coefficient quantization in FIR filters.