Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

Manipal School of Information Sciences (MSIS), Manipal
Second Semester Master of Engineering - ME (Embedded Systems) Degree Makeup Examination - June 2023

Digital Signal Processing [ESD 5001]

Marks: 100   **Duration: 180 mins.**

Wednesday, June 28, 2023

Answer all the questions.

1)	Implement a Radix-2 DIT-FFT algorithm with N = 8. Compare the number of complex multiplication and addition with that of Direct DFT computation	(10)
2)	Sketch the hardware for the following system function using Direct form-I, Direct form-II and Cascade form $H(z) = [(z^{-2} + z^{-1} + 1) / (z^{-2} - 1)] + [(z^{-1} + 1) / (z^{-2} + 2z^{-1} + 2)]$	(10)
3)	Design and Construct the hardware of an FIR filter using frequency sampling technique for the following impulse response $h(n) = 2\delta(n) + 0.5\delta(n-1) + 0.5\delta(n-7)$	(10)
4)	Design and construct the hardware for an ideal FIR filter with the following specification using Hamming window. $H_d(e^{jw}) = e^{-5jw}$ for $\pi/6 \leq |w| \leq \pi/2$ $H_d(e^{jw}) = 0$; elsewhere.	(10)
5)	Design and Construct the hardware using impulse invariance transformation, a digital Chebychev lowpass filter for the following specification $|H(j\Omega)| \geq$ -0.5 dB $0 \leq \Omega \leq 50$ rads/sec $|H(j\Omega)| \leq$ -50 dB $\Omega \geq 500$ rads/sec. Assume the sampling frequency to be 4k rads/sec.	(20)
6)	What is Multirate Signal Processing? Demonstrate the expressions both in time domain and frequency domain for the signal which is down sampled by an integer factor D	(10)
7)	What are QMF filter banks? Demonstrate the expression for the spectrum of the output of the QMF filter bank	(10)
8)	Explain LMS adaptive algorithm. Demonstrate how LMS adaptive algorithm is made use to make the Weiner Noise Canceller Configuration adaptive based on the steepest descent technique	(10)
9)	Explain why MAC operation is implemented in PDSPs hardware? Explain with necessary figures, how convolution is performed using a single MAC unit in PDSPs. Give the difference between a MAC instruction and MAC with data shift instruction	(10)

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