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1. In the frequency sampling method for FIR filter design, we specify the desired frequency response Hd(ω) at a set of equally spaced frequencies.
a) True
b) False
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Answer: a
Explanation: In the frequency sampling method, we specify the frequency response Hd(ω) at a set of equally spaced frequencies, namely
$\omega_k = \frac{2\pi}{M}(k+\alpha)$

2. To reduce side lobes, in which region of the filter the frequency specifications has to be optimized?
a) Stop band
b) Pass band
c) Transition band
d) None of the mentioned
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Answer: c
Explanation: To reduce the side lobes, it is desirable to optimize the frequency specification in the transition band of the filter. This optimization can be accomplished numerically on a digital computer by means of linear programming techniques.

3. What is the frequency response of a system with input h(n) and window length of M?
a) $\sum_{n=0}^{M-1} h(n)e^{j\omega n}$

b) $\sum_{n=0}^{M} h(n)e^{j\omega n}$

c) $\sum_{n=0}^{M} h(n)e^{-j\omega n}$

d) $\sum_{n=0}^{M-1} h(n)e^{-j\omega n}$
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Answer: d
Explanation: The desired output of an FIR filter with an input h(n) and using a window of length M is given as
$H(\omega)= \sum_{n=0}^{M-1} h(n)e^{-j\omega n}$

4. What is the relation between H(k+α) and h(n)?
a) $H(k+\alpha)= \sum_{n=0}^{M+1} h(n)e^{-j2\pi(k+\alpha)n/M}$;k=0,1,2...M+1
b) $H(k+\alpha)= \sum_{n=0}^{M-1} h(n)e^{-j2\pi(k+\alpha)n/M}$;k=0,1,2...M-1
c) $H(k+\alpha)= \sum_{n=0}^{M} h(n)e^{-j2\pi(k+\alpha)n/M}$;k=0,1,2...M
d) None of the mentioned
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Answer: b

Explanation: We know that

$$\omega_k=\frac{2\pi}{M}(k+\alpha) \text{ and } H(\omega)=\sum_{n=0}^{M-1} h(n)e^{-j\omega n}$$

Thus from substituting the first in the second equation, we get

$$H(k+\alpha)=\sum_{n=0}^{M-1} h(n)e^{-j2\pi(k+\alpha)n/M} \;;k=0,1,2...M-1$$

5. Which of the following is the correct expression for h(n) in terms of H(k+α)?

a) $\frac{1}{M}\sum_{k=0}^{M-1} H(k+\alpha)e^{j2\pi(k+\alpha)n/M}$;n=0,1,2...M-1

b) $\sum_{k=0}^{M-1} H(k+\alpha)e^{j2\pi(k+\alpha)n/M}$;n=0,1,2...M-1

c) $\frac{1}{M}\sum_{k=0}^{M+1} H(k+\alpha)e^{j2\pi(k+\alpha)n/M}$;n=0,1,2...M+1

d) $\sum_{k=0}^{M+1} H(k+\alpha)e^{j2\pi(k+\alpha)n/M}$;n=0,1,2...M+1

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Answer: a

Explanation: We know that

$H(k+\alpha)=\sum_{n=0}^{M-1} h(n)e^{-j2\pi(k+\alpha)n/M}$;k=0,1,2...M-1

If we multiply the above equation on both sides by the exponential exp(j2πkm/M), m=0,1,2….M-1 and sum over k=0,1,….M-1, we get the equation

$h(n)=\frac{1}{M}\sum_{k=0}^{M-1} H(k+\alpha)e^{j2\pi(k+\alpha)n/M}$;n=0,1,2...M-1

6. Which of the following is equal to the value of H(k+α)?

a) H*(M-k+α)

b) H*(M+k+α)

c) H*(M+k-α)

d) H*(M-k-α)

View Answer

Answer: d

Explanation: Since {h(n)} is real, we can easily show that the frequency samples {H(k+α)} satisfy the symmetry condition

H(k+α)= H*(M-k-α).

7. The linear equations for determining {h(n)} from {H(k+α)} are not simplified.

a) True

b) False

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8. The major advantage of designing linear phase FIR filter using frequency sampling method lies in the efficient frequency sampling structure.

a) True

b) False

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Answer: a

Explanation: Although the frequency sampling method provides us with another means for designing linear phase FIR filters, its major advantage lies in the efficient frequency sampling structure, which is obtained when most of the frequency samples are zero.

9. Which of the following is introduced in the frequency sampling realization of the FIR filter?
a) Poles are more in number on unit circle
b) Zeros are more in number on the unit circle
c) Poles and zeros at equally spaced points on the unit circle
d) None of the mentioned
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Answer: c
Explanation: There is a potential problem for frequency sampling realization of the FIR linear phase filter. The frequency sampling realization of the FIR filter introduces poles and zeros at equally spaced points on the unit circle.

10. In a practical implementation of the frequency sampling realization, quantization effects preclude a perfect cancellation of the poles and zeros.
a) True
b) False
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Answer: a
Explanation: In the ideal situation, the zeros cancel the poles and, consequently, the actual zeros of the H(z) are determined by the selection of the frequency samples $H(k+\alpha)$. In a practical implementation of the frequency sampling realization, however, quantization effects preclude a perfect cancellation of the poles and zeros.