1. What is the primary reason for decomposing signals into complex exponentials in LTI systems?
A) To reduce computational complexity
B) Complex exponentials are eigenfunctions of LTI systems
C) To ensure time-domain symmetry
D) To minimize signal distortion
Answer: B) Complex exponentials are eigenfunctions of LTI systems**
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2. How many distinct complex exponentials are available for representing a periodic discrete-time s
A) 2π
B) N
C) $2N$
D) ∞
Answer: B) N**
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3. What happens to the spacing of Fourier series coefficients as the period N of a signal increas
A) Spacing becomes coarser
B) Spacing becomes finer
C) Spacing remains constant
D) Spacing alternates randomly
Answer: B) Spacing becomes finer**
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4. Which is a key difference between the discrete-time Fourier transform (DTFT) and the continuous
A) DTFT uses integrals; continuous uses summations
B) DTFT is periodic in frequency; continuous is aperiodic
C) DTFT applies only to periodic signals
D) DTFT coefficients are always real-valued
Answer: B) DTFT is periodic in frequency; continuous is aperiodic**
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5. The analysis equation for the discrete-time Fourier series (DTFS) is best described by which form
A) $x[n] = \sum_{k=0}^{N-1} a_k e^{jk\Omega_0 n}$
B) $a_k = \frac{1}{N} \sum_{n=0}^{N-1} x[n] e^{-jk\Omega_0 n}$
C) $X(\Omega) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\Omega n}$
D) $x[n] = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(\Omega) e^{j\Omega n} d\Omega$
Answer: B) $a_k = \frac{1}{N} \sum_{n=0}^{N-1} x[n] e^{-jk\Omega_0 n}$**
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6. Why are the Fourier series coefficients of a discrete-time periodic signal considered periodic? (M
A) The time-domain signal is aperiodic
B) Complex exponentials are periodic in k with period N
C) The analysis equation involves integration
D) The coefficients depend on the envelope function
Answer: B) Complex exponentials are periodic in k with period N**
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7. The envelope function for Fourier series coefficients depends on: (Hard)**
A) The period \(N \) of the signal
B) The behavior of the sequence over one period
C) The number of distinct complex exponentials
D) The spacing of the frequency axis
****Answer:** B) The behavior of the sequence over one period**
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8. What is the Fourier transform of a periodic discrete-time signal \(\tilde{x}[n] \)? (Hard)**
A) A continuous function of frequency
B) A summation of Dirac delta functions
C) An impulse train at harmonic frequencies \(k\Omega_0 \)
D) A non-periodic envelope
****Answer:** C) An impulse train at harmonic frequencies \(k\Omega_0 \)**
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9. How is the discrete-time Fourier transform (DTFT) derived from the Fourier series for an aperiodi
A) By increasing the period \(N \) until it approaches infinity
B) By decreasing the period \(N \) to zero
C) By sampling the Fourier series coefficients
D) By truncating the time-domain signal
****Answer:** A) By increasing the period \(N \) until it approaches infinity**
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10. What is the effect of an LTI system on a complex exponential input \(e^{j\Omega n} \)? (Easy)**
A) Time reversal
B) A phase shift and amplitude scaling
C) Differentiation in the frequency domain
D) Conversion to a sinusoidal output
****Answer:** B) A phase shift and amplitude scaling**
