1. What characterizes harmonic vibration in a mechanical system?

a) Random oscillations
b) Periodic oscillations
c) Non-linear oscillations
d) Continuous vibrations

Answer: b) Periodic oscillations

Explanation: Harmonic vibration refers to the periodic oscillation of a system around an equilibrium position. This motion repeats at regular intervals over time.

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2. In an undamped harmonic system, what happens to the amplitude of vibration over time?

a) It decreases
b) It increases
c) It remains constant
d) It oscillates randomly

Answer: c) It remains constant

Explanation: In an undamped harmonic system, there is no dissipation of energy, so the amplitude of vibration remains constant over time.

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3. What role does damping play in a vibrational system?

a) Increases the natural frequency
b) Reduces the natural frequency
c) Amplifies the amplitude
d) Has no effect on the vibration

Answer: b) Reduces the natural frequency

Explanation: Damping in a system reduces the natural frequency, affecting the rate at which the system oscillates and the amplitude of vibration.

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4. Which term describes the measure of a system’s resistance to oscillation?

a) Damping ratio
b) Natural frequency
c) Amplitude
d) Phase angle

Answer: a) Damping ratio

Explanation: Damping ratio quantifies the level of damping in a system, determining how

quickly oscillations decay.

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5. What is the significance of the natural frequency in a vibrational system?

a) It determines the damping ratio
b) It defines the amplitude of vibration
c) It represents the frequency at which the system oscillates with minimum external force
d) It indicates the phase shift

Answer: c) It represents the frequency at which the system oscillates with minimum external force

Explanation: The natural frequency is the frequency at which a system oscillates when no external force is applied, representing its inherent vibrational behavior.

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6. How does Fourier series representation aid in analyzing vibrations?

a) It provides a graphical representation of vibrations
b) It simplifies complex waveforms into simpler components
c) It calculates damping ratios
d) It measures the phase angle

Answer: b) It simplifies complex waveforms into simpler components

Explanation: Fourier series breaks down complex periodic functions into simpler trigonometric functions, facilitating analysis of vibration patterns.

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7. What is the primary purpose of vibration isolation systems?

a) To amplify vibrations
b) To reduce vibrations transmitted to surrounding structures
c) To increase the natural frequency
d) To introduce damping

Answer: b) To reduce vibrations transmitted to surrounding structures

Explanation: Vibration isolation systems are designed to minimize the transmission of vibrations from one system to another, thus preventing structural damage and disturbances.

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8. How does a periodic force affect the response of a vibrating system?

a) It increases damping
b) It decreases the natural frequency
c) It induces resonance

d) It has no effect on vibration

Answer: c) It induces resonance

Explanation: A periodic force can lead to resonance in a vibrating system, causing significant amplification of vibrations if the force frequency matches the system’s natural frequency.

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9. What does the Fourier series allow engineers to do in terms of system analysis?

a) Predict the natural frequency
b) Decompose complex vibrations into simpler components
c) Calculate damping ratios
d) Determine phase shifts

Answer: b) Decompose complex vibrations into simpler components

Explanation: Fourier series decomposition simplifies complex vibrations into a sum of simpler sinusoidal functions, aiding in the analysis of vibrational behavior.

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10. How does viscosity impact damping in a vibrational system?

a) Increases damping

b) Decreases damping
c) Does not affect damping
d) Randomizes damping

Answer: a) Increases damping

Explanation: Viscosity in a system increases damping by dissipating energy, thereby reducing the amplitude of vibrations over time.

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