ASNT Phased Array Level II Practice Test (Sample)

Study Guide

Everything you need from our exam experts!

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Questions

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1. Which phased array scan refers to the movement of the beam across a defined range of angles using the same set of elements?

A. Linear scan.

B. Electronic scan.

C. Azimuthal scan.

D. Raster scan.

2. What is true about the active aperture in PAUT?

A. It is always constant.

B. It can be electronically focused.

C. It can be focused longer than the near field length.

D. It can be adjusted to display dispersion curves.

3. When waves combine out of phase, what is the result?

A. Reinforcement of each other

B. Cancellation of each other

C. Behavior due to Lorentz force

D. Effects at peak frequency

4. Which is an advantage of using sectorial scans in PAUT?

A. They provide a limited view of the test area

B. They allow for better defect detection in the weld area

C. They are less time-consuming than linear scans

D. They only show surface defects

5. What is "mode conversion" in the context of ultrasonic waves?

A. The change in frequency of the wave

B. The phenomenon where an ultrasonic wave changes from one mode to another upon encountering a boundary

C. The variation of ultrasonic waves due to temperature changes

D. The loss of signal intensity over distance

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6. In PAUT, what does the adjustment of depth calibration ensure?

- **A. Accurate correlation of displayed and actual defect locations**
- **B. Improvement of image resolution**
- **C. Stabilization of temperature variations**
- **D. Increased speed of sound in materials**

7. What is the primary use of EDM notches in a rectangular prism reference reflector?

- **A. Sensitivity.**
- **B. Lateral resolution.**
- **C. Time-based calibration.**
- **D. DAC.**

8. Which factor determines the angle of incidence in ultrasound inspections?

- **A. Material temperature.**
- **B. Probe size.**
- **C. Relative sound speed.**
- **D. Sound frequency.**

9. What is the purpose of "data reporting" in PAUT inspections?

- **A. To document and communicate inspection findings, aiding in decision-making and compliance**
- **B. To generate random quality metrics**
- **C. To improve the speed of the inspection process**
- **D. To prepare the equipment for future inspections**

10. What is meant by "depth calibration" in PAUT inspections?

- **A. Ensuring the equipment is set to the correct temperature**
- **B. Adjusting the system so defect depths are accurately displayed**
- **C. Calibrating the angle of incidence for ultrasonic waves**
- **D. Setting the speed of sound for the material being tested**

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Answers

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1. C
2. B
3. B
4. B
5. B
6. A
7. A
8. C
9. A
10. B

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Explanations

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1. Which phased array scan refers to the movement of the beam across a defined range of angles using the same set of elements?

A. Linear scan.

B. Electronic scan.

C. Azimuthal scan.

D. Raster scan.

The correct choice highlights the concept of azimuthal scanning, which entails the movement of the ultrasound beam across a predetermined range of angles while utilizing a consistent set of transducer elements. This method is particularly advantageous in Phased Array Ultrasonics, as it allows for the effective inspection of welds, joints, and other critical areas by achieving comprehensive coverage without the need to reposition the transducer itself. In azimuthal scanning, the beam is electronically controlled to steer it at various angles, providing a better visualization of the internal structure of the material being inspected. This scanning technique is essential for accurately locating and characterizing defects based on their orientation and position relative to the transducer. The other options refer to different scanning methods. For instance, a linear scan moves the beam in a straight line, covering a range of positions along a single axis rather than varying angles. An electronic scan, although it implies the use of electronic steering, does not specifically indicate the movement across a range of angles as defined in the question. Lastly, a raster scan typically denotes a systematic pattern, similar to how a printer would operate, covering an area in a grid-like fashion rather than focusing on angular movement pertinent to azimuthal scanning.

2. What is true about the active aperture in PAUT?

A. It is always constant.

B. It can be electronically focused.

C. It can be focused longer than the near field length.

D. It can be adjusted to display dispersion curves.

In Phased Array Ultrasonic Testing (PAUT), the active aperture refers to the portion of the transducer array that is being utilized to generate and receive ultrasonic waves at a given time. The ability to electronically focus the active aperture is a fundamental characteristic of phased array systems. This means that by adjusting the timing of the ultrasound pulses emitted by various elements of the array, the system can direct the sound beam and focus it at different depths within the material being tested without the need for mechanical movement. Electronic focusing is vital because it allows for improved penetration and resolution at different points, enhancing the detection of flaws or discontinuities within complex geometries. This electronic capability is a significant advantage of phased array technology compared to conventional ultrasonic testing methods, which often rely on fixed focal lengths and manual manipulation to achieve similar results. The other options imply characteristics that do not accurately describe the nature of the active aperture in PAUT. For instance, the active aperture can vary in size depending on the settings and desired focus, so it is not always constant. Also, focusing beyond the near field length is not typically feasible as it leads to diffraction effects that can reduce the quality of the returned signals. Lastly, while adjustments can be made for various analysis methods, the active aperture

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3. When waves combine out of phase, what is the result?

A. Reinforcement of each other

B. Cancellation of each other

C. Behavior due to Lorentz force

D. Effects at peak frequency

When waves combine out of phase, they effectively negate each other, resulting in cancellation. This phenomenon occurs when the peaks of one wave align with the troughs of another wave, which leads to destructive interference. The amplitude of the resulting wave is reduced or may even result in a complete cancellation, depending on the relative amplitudes of the original waves. In many applications, such as acoustic and electromagnetic wave studies, understanding when waves will cancel each other is crucial. This principle is important for applications like noise-canceling headphones, where opposing sound waves are used to reduce unwanted noise. Thus, the scenario is consistent with the observed behaviors of waves experiencing such interference. The other options don't directly pertain to this principle of wave behavior.

4. Which is an advantage of using sectorial scans in PAUT?

A. They provide a limited view of the test area

B. They allow for better defect detection in the weld area

C. They are less time-consuming than linear scans

D. They only show surface defects

Using sectorial scans in Phased Array Ultrasonic Testing (PAUT) offers significant advantages, particularly in enhancing defect detection within complex geometries such as weld areas. Sectorial scans work by sweeping the ultrasonic beam through a sector of angles, allowing for dynamic coverage of a larger volume and providing detailed visualization of the inspected area. This approach is particularly beneficial in weld inspections where defects can occur in different orientations and depths. By utilizing sectorial scanning, technicians can effectively capture data from varying angles and identify critical indications that might be missed with more limited scanning techniques. This capability results in a more comprehensive assessment of the integrity of the weld, highlighting both volumetric and planar defects that could affect the structural soundness. In summary, the primary advantage of sectorial scans in PAUT lies in their ability to enhance defect detection, especially in complex areas like welds, where multiple angles may present the most accurate and thorough assessment of potential flaws.

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5. What is "mode conversion" in the context of ultrasonic waves?

A. The change in frequency of the wave

B. The phenomenon where an ultrasonic wave changes from one mode to another upon encountering a boundary

C. The variation of ultrasonic waves due to temperature changes

D. The loss of signal intensity over distance

Mode conversion refers specifically to the change that occurs when an ultrasonic wave changes from one mode of propagation to another as it interacts with a boundary or interface between different materials. This can happen, for example, when a longitudinal wave traveling through one medium encounters an interface that leads to the generation of shear waves or another type of wave mode in the adjacent medium. Understanding mode conversion is crucial because it affects how waves propagate through materials, influencing aspects such as the sensitivity of the detection process and the interpretation of data gathered during ultrasonic testing. The ability of waves to convert between modes can produce different characteristics in the received signals, which can be essential for accurate analysis and evaluation in non-destructive testing applications. The other choices describe different phenomena associated with ultrasonic wave behavior but do not accurately depict the concept of mode conversion. For instance, changes in frequency are indicative of the Doppler effect rather than mode conversion, temperature variations affect wave speed but not the mode itself, and signal intensity loss with distance pertains to attenuation, not mode conversion. Thus, the correct understanding of mode conversion is critical for effective ultrasonic testing and analysis.

6. In PAUT, what does the adjustment of depth calibration ensure?

A. Accurate correlation of displayed and actual defect locations

B. Improvement of image resolution

C. Stabilization of temperature variations

D. Increased speed of sound in materials

The adjustment of depth calibration in Phased Array Ultrasonic Testing (PAUT) is crucial because it ensures that the displayed defect locations on the screen correspond accurately with their actual locations within the material being tested. This correlation is vital for effective interpretation and assessment of the integrity of components. Depth calibration accounts for the sound wave's travel time through the material, factoring in properties such as material type and thickness, which can affect the time it takes for the ultrasonic waves to return after reflecting off a defect. By fine-tuning the depth calibration, technicians can effectively overlay the ultrasonic data with precise depth measurements, facilitating reliable identification of defects during inspections. Though image resolution, temperature stabilization, and sound speed relevant to material properties are important aspects of ultrasonic testing, they are not directly linked to the specific function of depth calibration in ensuring correct defect location representation in a PAUT setup.

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7. What is the primary use of EDM notches in a rectangular prism reference reflector?

A. Sensitivity.

B. Lateral resolution.

C. Time-based calibration.

D. DAC.

The primary use of EDM (Electrical Discharge Machining) notches in a rectangular prism reference reflector is to serve as a means of assessing and calibrating sensitivity in ultrasonic testing. These notches provide specific, controlled discontinuities within the material, which can be used to verify and adjust the sensitivity of the phased array system. When performing ultrasonic testing, it is crucial to ensure that the system is responsive to small flaws or discontinuities. The EDM notches, being precisely machined, create known reflectors that help in determining the minimum level of signal that can be detected. This is fundamental in evaluating the system's performance and ensuring that it can reliably identify real defects in test specimens. By comparing the signals received from these notches, technicians can establish the baseline sensitivity of their equipment. In summary, EDM notches are essential for calibrating and verifying the sensitivity of inspection equipment, making them a vital component in maintaining quality assurance in ultrasonic testing.

8. Which factor determines the angle of incidence in ultrasound inspections?

A. Material temperature.

B. Probe size.

C. Relative sound speed.

D. Sound frequency.

The angle of incidence during ultrasound inspections is primarily influenced by the relative sound speed in the materials being inspected. The relationship between the angle of incidence and the sound speed is governed by Snell's Law, which states that the angle of incidence is determined by the ratio of the velocities of sound in the two different media at the interface. When sound waves travel from one medium to another, the change in speed alters the angle at which the waves enter the second medium. While temperature can affect sound speed, it is not a direct determinant of the angle of incidence itself. Probe size and sound frequency can influence various factors in the inspection process, such as resolution and penetration, but they do not dictate the angle of incidence directly. Thus, the correct choice highlights the fundamental physics that underpins the behavior of sound waves at different media interfaces, which is essential knowledge for effective ultrasound inspections.

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9. What is the purpose of "data reporting" in PAUT inspections?

A. To document and communicate inspection findings, aiding in decision-making and compliance

B. To generate random quality metrics

C. To improve the speed of the inspection process

D. To prepare the equipment for future inspections

In Phased Array Ultrasonic Testing (PAUT), the purpose of data reporting is crucial as it serves to document and communicate inspection findings effectively. This process is essential for ensuring that all relevant information gathered during the inspection is accurately relayed to stakeholders, which aids in making informed decisions regarding the integrity and safety of the component or structure being inspected. Comprehensive data reporting allows for proper record-keeping, compliance with regulatory requirements, and tracking trends over time in inspection outcomes. This documentation acts as a crucial reference for future inspections and maintenance decisions, thereby supporting ongoing quality assurance efforts. The other choices do not encompass the primary role of data reporting within PAUT inspections. Generating random quality metrics does not reflect the structured and purpose-driven nature of reporting inspection data. Improving speed is not a primary purpose of data reporting, as the focus is more on accuracy and completeness than on hastening the inspection process. Lastly, preparing equipment for future inspections pertains more to maintenance and calibration rather than to the communication and decision-making aspects of inspection results.

10. What is meant by "depth calibration" in PAUT inspections?

A. Ensuring the equipment is set to the correct temperature

B. Adjusting the system so defect depths are accurately displayed

C. Calibrating the angle of incidence for ultrasonic waves

D. Setting the speed of sound for the material being tested

Depth calibration in Phased Array Ultrasonic Testing (PAUT) refers to the process of adjusting the system to ensure that the depths of detected defects are displayed accurately on the inspection results. This process is crucial because ultrasonic testing relies on the time it takes for sound waves to travel through a material and reflect back after hitting a flaw. Accurate depth representation allows inspectors to assess the severity and location of defects effectively, which is key for safety and structural integrity evaluations. By calibrating the depth, technicians can confirm that the measurements correspond with the actual positions of defects within the material. This ensures reliability in diagnostic assessments. Other options, while important in their own right (such as speed of sound adjustments for different materials), do not directly relate to the accuracy of defect depth representation that depth calibration specifically addresses.

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