Aerospace Structures Pre-Laboratory
Lab 9 Introduction to Nondestructive Evaluation
Section 4 Group 2
Matthew Mehrtens

AER E 322   April 5, 2023   **Spring 2023**

Question 1

(4 points) *In a sentence or two, state your definition of NDE.*

Solution:

Nondestructive Evaluation (NDE) is a term describing analysis techniques that do not significantly disturb the material being tested. NDE techniques utilize everything from chemical testing to ultrasonic or acoustic evaluation.

Question 2

(3 points each) *Under what technology category (e.g. visual examination, chemical testing, etc.) is each of the three NDE techniques learned in this lab?*

Solution:

- Tap Testing; tap testing is a form of mechanical vibration testing.

- Ultrasonic Testing; ultrasonic testing is a form of mechanical vibration testing.

- Eddy Current Testing; eddy current testing is a form of electromagnetic radiation testing.

Question 3

(5 points) *How does tap testing determine the local stiffness of the part under testing?* (3 points) *What is being measured?*

Solution:

The computer-aided tap tester (CATT) taps the material and measures the contact time of the tap. By using the relationship

$$T = \pi \sqrt{\frac{M}{K}} \tag{1}$$

where T is the contact time in seconds, M is the mass of the tapper head, and K is the local stiffness of the material. The CATT is used in a grid pattern to generate a test image.

Aerospace Structures Pre-Laboratory
Lab 9 Introduction to Nondestructive Evaluation
Section 4 Group 2
Matthew Mehrtens

AER E 322   April 5, 2023   **Spring 2023**

Question 4

(3 points each) *What are the three basic components in an ultrasonic immersion testing system?*

Solution:

1. Transducer (TR)

2. Pulser/Receiver (P/R)

3. Oscilloscope

Question 5

(15 points) *For the ultrasonic immersion testing, you are instructed to follow a strategy of "sequential search". Describe what this is and how it will be executed in the lab.*

Solution:

The sequential search method describes a method of locating flaws by first identifying a set of intermediate targets. In this lab, we will locate the signal just leaving the transducer face, then the front surface, back surface, and finally the flaw.

To accomplish this, we first have to ensure the water path is within 4.5 in. This is done by using the oscilloscope and the equations in the lecture notes. This process will also find the signal of the transducer face and the front surface. Next, we need to locate the back surface signal. Using the known thickness of the disk, we can calculate the time difference between the front and bottom surfaces.

Now that the back surface has been located, our group will search spatially, *i.e.*, search all possible areas on the back surface, until the flaw is located. Finally, we have to determine the flaw size using amplitude profiling. This is done by assuming the peak-to-peak amplitude occurs at the at flaw center.

Question 6

(10 points each) *Describe what are A-, B- and C-scans in an ultrasonic testing?*

Aerospace Structures Pre-Laboratory
Lab 9 Introduction to Nondestructive Evaluation
Section 4 Group 2
Matthew Mehrtens

AER E 322   April 5, 2023   **Spring 2023**

Solution:

The A-scan is a one-dimensional graph of the UT signal amplitudes. The height of the peaks shows the strength of the reflection and the distance along the x-axis shows the depth of the reflections.

The B-scan creates a type of contour graph. The graph is generated by plotting the amplitude values of each A-scan as a vertical stack of pixels to create a 3-D contour.

The C-scan creates a 2-D graph of the top-down view of a specimen. The plot is generated by plotting each peak-peak amplitude of the A-scans as a colored pixel value to generate a 2-D image.

Question 7

(10 points) *From what you learn in lecture notes, how does eddy current testing work?*

Solution:

Question 8

(10 points) *Why is eddy current testing useful for sorting out metallic materials?*

Solution: