Non-Destructive evaluation using ultrasonic technique and distributed Blackboard System

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Non-Destructive Evaluation Using Ultrasonic Technique And Distributed Blackboard System

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Goal

The ultimate goal is to prevent these incidents from happening:

What do these have in common?
An American Airlines passenger jet (AA587) crashes near John F Kennedy airport killing at least 260 people in October 2001. **Metal failure is the suspected caused of the crash.**
Hatfield train crash killed four people and injured 70 in October 2000.

**Crash caused by defected rail.**
Sunken Tanker

Tanker Erika sank and released oil which caused serious pollution in December 1999.

Caused by structural weakness.
Causes

What is the main cause of these disasters?

Cracks
Non-destructive Evaluation

- **Ultrasonic Inspection**
  can visualise the inside of a metal specimen without damaging it.

- **Image Creation**
  record the ultrasonic data and produce an visible image.

- **Evaluation**
  using AI techniques to evaluate the ultrasonic image.
Equipment

- Scanning direction
- Staining from couplant
- Probes
- Cables to ultrasonic equipment & computer
My Demonstration

- To find hidden cracks inside this ferritic steel plate.
- An array of ten transducers scanned across the surface of the plate in a raster fashion.
My Demonstration Continue

• A 2-D image of the cross-section view of the specimen is produced each pass of the probes across the surface of the plate.
• To reduce the effect of noise, only indications of intensity > -30dB were recorded.
• Echoes caused by a defect in the specimen leads to a feature in the image, but features may also occur which are not directly associated with defects.
Stages of interpretation

- **Find lines of indications**
  These lines are caused by echoes from a point in the sample detected by a transducer in contiguous positions.

- **Extract readily identifiable features**
  Some features may be immediately identified, such as the “back wall” or the reverberations in the transducers.
Stages of interpretation Continue

- Locate and classify possible defect areas
  Areas of intersection of lines are often indicative of the presence of a defect. Local information can be used to classify defects.

- Look for verification
  Non-local factors such as the intensity profile of the back wall can be used to verify the defect.
Stages of interpretation: 1
Stages of interpretation: 2
Stages of interpretation: 3
Stages of interpretation: 4
Demonstration

Which scan do you want to see?

Scan Number 2
Scan Number 3
Scan Number 7
Scan Number 8
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