

Multimedia Courses Advanced Ultrasonic Testing

PHASED ARRAY

TOFD

A PHASED ARRAY

PHASED ARRAY TECHNOLOGY

PHASED ARRAY PROBE

WORKING PRINCIPLES

ELECTRONIC SCANNING

BEAM FOCUSING

SIGNAL PRESENTATION

CALIBRATIONS

CHARACTERIZATIONS AND SIZING OF DEFECTS

APPLICATION FOR WELD INSPECTION

SELF-EVALUATION TESTS



B TOFD (Time Of Flight Diffraction)

INTRODUCTION TO TECHNIQUES

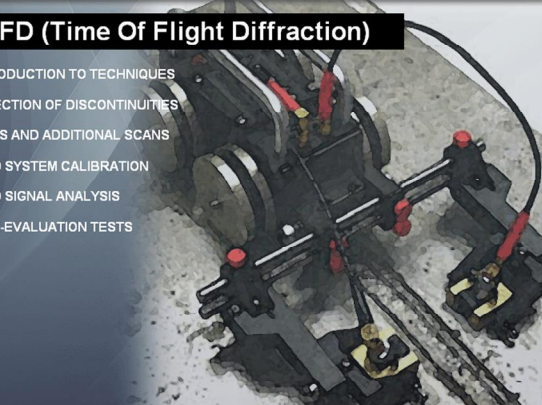
DETECTION OF DISCONTINUITIES

LIMITS AND ADDITIONAL SCANS

TOFD SYSTEM CALIBRATION

TOFD SIGNAL ANALYSIS

SELF-EVALUATION TESTS



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Phased Array :: Electronic Scanning A.54

Electronic scanning modes 5/6
Sectorial scanning 2/2

The main parameters to be set for programming a sectorial scan are as follows:

- virtual transducer (number of elements participating in the beam emission) 8
- initial scan angle 20
- final scan angle 50
- angular increment (to determine the increase of beam angle at each step of scanning) 1

The angular parameters (initial angle, final angle and angle step) determine the number of focal laws required by the scan. 31

The result is a sequence of activation of the same elements of the virtual transducer, in which the focal law is varied at each step to vary the beam emission angle (from the initial to the final angle).

Main parameters

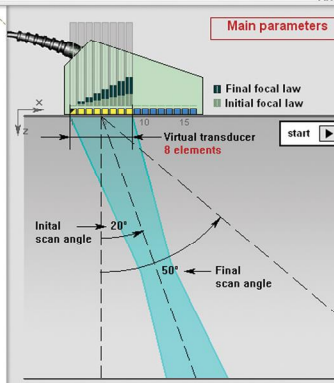
Final focal law

Initial focal law

Virtual transducer 8 elements

Initial scan angle 20°

Final scan angle 50°



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TOFD (Time Of Flight Diffraction) :: Introduction to techniques B.27

Data visualization 6/8
B-scan presentation 2/4

The B-scan presentation is constructed during the probe movement along the scan axis, encoding the succession of A-scan data acquired at constant intervals.

LW - Lateral Wave
UT - Upper Tip
LT - Lower Tip
BW - Back-Wall

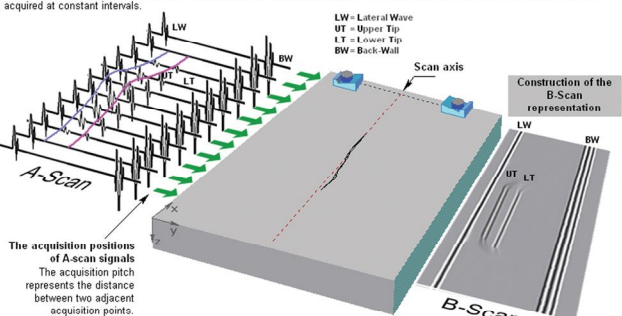
Scan axis

Construction of the B-Scan representation

A-Scan

B-Scan

The acquisition positions of A-scan signals
The acquisition pitch represents the distance between two adjacent acquisition points.



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Phased Array :: Signal Presentation A.102

S-scan presentation 6/6

b-scan c-scan S-SCAN

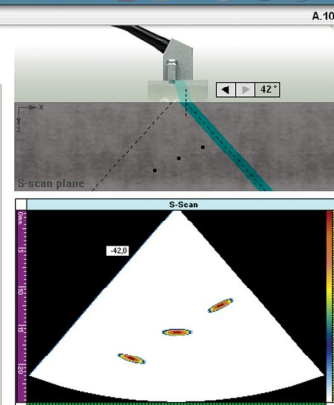
Probe: Straight (longitudinal wave)
 Angled (shear wave)

Angular half aperture: ± 42 [°]

S-scan map
S cursor: 42 [°]

A-scan map

Scanning



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TOFD (Time Of Flight Diffraction) :: TOFD system calibration B.92

System calibration

Shape: Circular Rectang. Wall thickness [mm] 300

Profile: -6 dB -20 dB Width of interest area [mm] 40

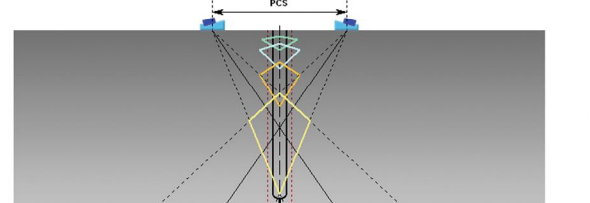
Geometric calibration

Inspection zones

SCAN No	Frequency [MHz]	TOFD PAIR Size [mm]	Angle [°]	PCS [mm]	FOCUS DEPTH [mm]	DEPTH SCANNED for [mm] to [mm]
1	5	6	70	110	20.0	9.8 31.6
2	2	12	60	138	39.8	21.9 63.0
3	2	12	45	160	80.0	51.2 125.1
4	2	12	35	224	160.0	103.0 269.0

Remove

PCS



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TOPICS

PHASED ARRAY

1. PHASED ARRAY TECHNOLOGY

- Introduction
- Advantages and disadvantages of PA

2. PHASED ARRAY PROBE

- Probe structure
- Transducer
- Wedge and types of waves

3. WORKING PRINCIPLES

- Beam forming
- Beam steering
- Acquisition cycles

4. ELECTRONIC SCANNING

- Electronic beam steering
- Electronic scanning modes

5. BEAM FOCUSING

- Focusing control
- Focusing modes
- Dynamic focusing
- Spatial resolution
- Probe resolution and characteristics

6. SIGNAL PRESENTATION

- Types of presentation
- A-scan presentation
- B-scan presentation
- C-scan presentation
- D-scan presentation
- S-scan presentation
- Combined presentations

7. CALIBRATIONS

- Calibration block
- Sensitivity adjustment
- Construction of DAC curves
- Determining the lateral resolutions
- Calibration curves for sizing

8. CHARACTERIZATIONS AND SIZING OF DEFECTS

- Types of defects
- Defect sizing
- Defect position

9. APPLICATION FOR WELD INSPECTION

- Phased Array Inspection
- Probe movement
- Scan lines
- Depth zones
- Multi-channel mode (virtual probe)
- Gate setting
- Focusing for welding
- Inspection speed
- Scan plan

TOFD

1. INTRODUCTION TO TECHNIQUES

- Advantages and disadvantages of TOFD
- Data visualization

2. DETECTION OF DISCONTINUITIES

- Defect inspection
- Defect characterisation
- Defect sizing

3. LIMITS AND ADDITIONAL SCANS

- Limitations of the technique
- Additional scans

4. TOFD SYSTEM CALIBRATION

- TOFD system structure
- System calibration
- Reference blocks
- Image quality

5. TOFD SIGNAL ANALYSIS

- Weld defects
- Sizing defects
- TOFD references

Minimum system requirements

- Microsoft Windows XP / Vista / Windows 7
- CD-ROM / DVD Drive
- Audio System

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