

Development of Automatic Ultrasonic Testing Techniques of Low Pressure Turbine Blade of Nuclear Power Plant

103-16

가 Pin Finger

2, 3

가

Abstract

As the increase of turbine running age in nuclear power plant, cracks have been found in the pin finger type blade root area . The Nondestructive examination in the blade root area has been done by manual ultrasonic examination during overhaul period but because of necessity to improve the reliability, KEPRI developed automatic ultrasonic examination system and technique. To verify the availability of the developed automatic ultrasonic examination system, low pressure turbine 2nd, 3rd stage blades of nuclear power plant were examined using developed system and application to other type nuclear power plant turbine root area examination was confirmed.

1.

Alsthome 가

가

Pin Finger

1

가

가

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2.

가 ,
 13% ,
 11,200mm 가 가 7 가 1 (Stage)
 7 가 . 1800rpm
 986MWe .
 Blade Disc Blade Root가 1 5 Pin Finger Type
 Blade가 . 15cm 23cm
 1 2 가 가 2 3
 가 60mm . Pin Finger Type 가
 Blade가
 Blade 가 Blade 가
 Finger Pin 가 . 1 Finger Pin 가 2 5
 Finger 가 4 . 6 1 5 Straight Fir Tree Type
 7 Curved Fir Tree
 Blade
 Blade 가 가 , Blade
 1 7 210 , 210 , 143 , 120 , 91 , 77 , 65 .



. 1 Alsthom



. 2 3

3.

(1)

2, 3

Pin Finger

. ANSYS

2 Hole

Pin Hole

Pin Hole Hole

Tangential Surface
Hole

0.25mm, 0.5mm, 1.0mm
가

Round Notch 0.5mm, 0.75mm, 1.0mm

Hole

Slit Notch
0.2mm



3.

(:2 , :3)



4.

(2) Mock up

Mockup

가
가

Mockup
가

Mockup

Mockup

2

6.5cm

Mockup

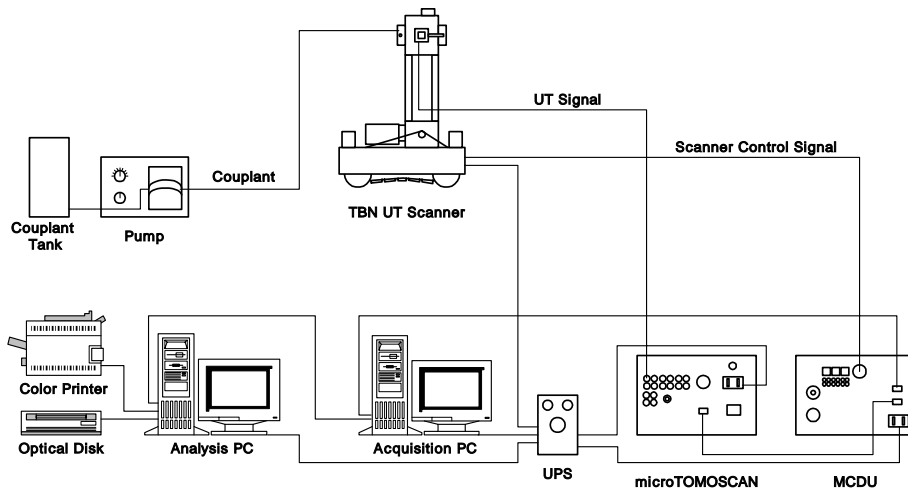
가



. 5

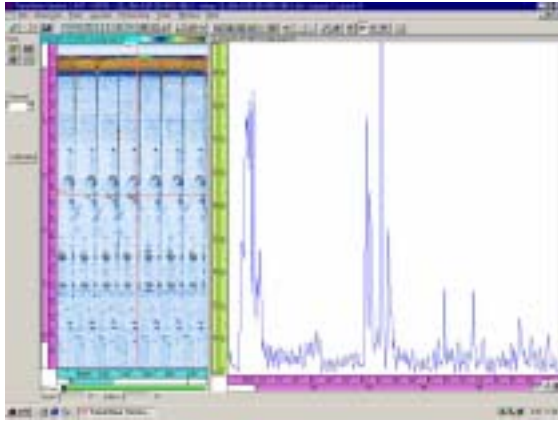
Mock up

가 PC,
 R/D-Tech μ Tomoscan
 Tomoview
 1
 MCDU-02 PC Tomoview 가
 Encorder 가
 Rotary
 가
 가 Pin Hole
 가
 4x4, 5MHz,
 35 ~ 45

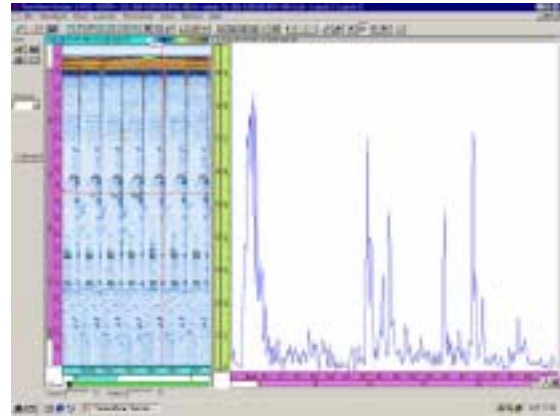


. 7

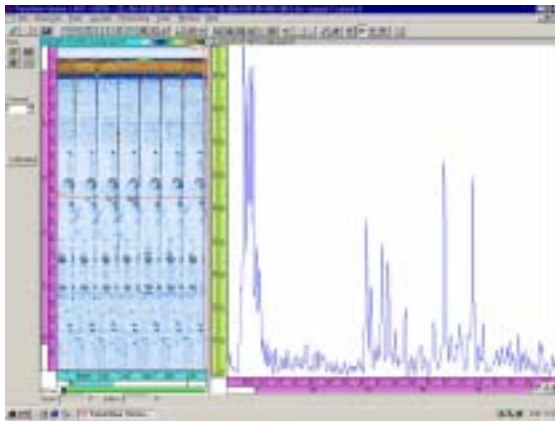
4.
 Digitizing Rate, Data , Encorder Resolution 가
 가 Averaging : 1, Digitizing Freq. : 15.624,
 Acquisition : 60, Recurrence : 2000
 2, 3 Pin



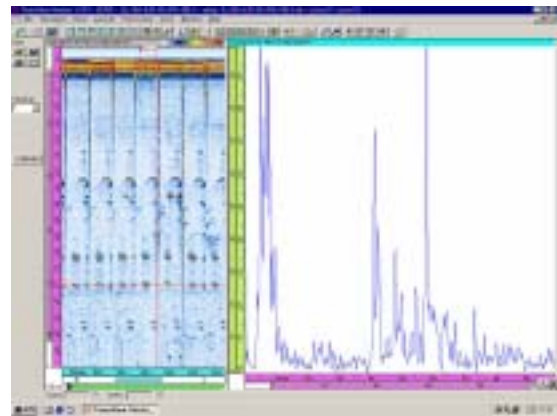
. 10 3 Slit Notch 1.0mm 가



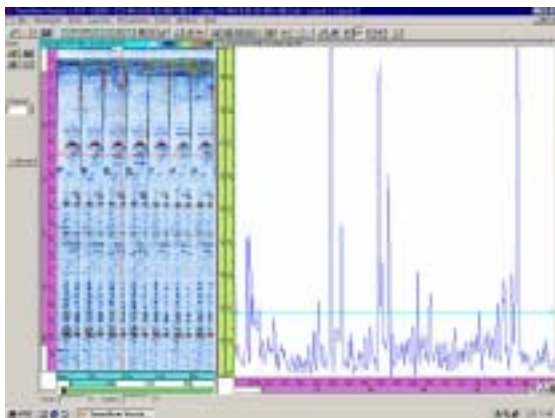
. 11 3 Round Notch 0.5mm 가



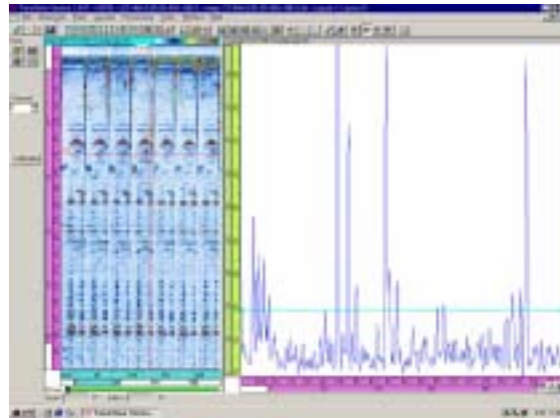
. 12 3 Round Notch 1.0mm 가



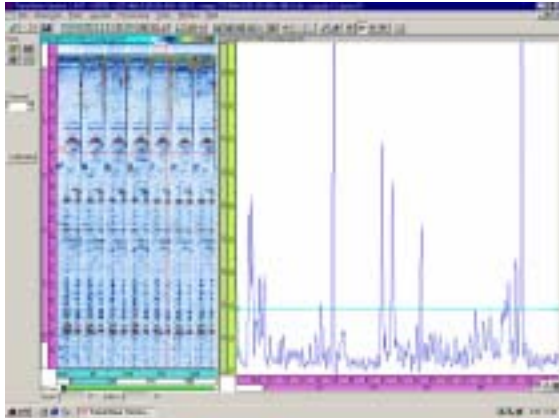
. 13 3



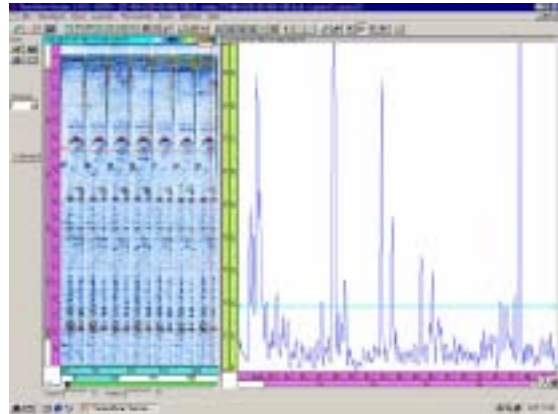
. 14 2 Slit Notch 0.5mm 가



. 15 2 Slit Notch 1.0mm 가



. 16 2 Round Notch 0.5mm 가



. 17 2 Round Notch 1.0mm 가

5.

,
Data

2, 3

2, 3

가



. 18

6.

2, 3

가

가

가

가 . 가

Scan B-Scan

1

가

1
A-

가

Reference

1. "Inspection of Turbine Disk Blade Attachment Guide", EPRI TR-104026, 1994
2. "Third EPRI Turbine and Generator NDE, Life Assessment and Maintenance Workshop", EPRI TR-103392, 1994
3. "Round-Robin Turbine Blade Attachment Inspection Program", EPRI-TR-106749, 1997
4. "Guide to Optimized Nuclear Low-Pressure Turbine Rotor Inspection", TR-107480, 1997
5. "Steam Turbine Disk Blade Attachment Inspection Using Linear Phased Array Ultrasonic Technology", EPRI GC-110446, 1998