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R&D ACTIVITIES OF AUTOMATION LABORATORY, CHOSUN UNIVERSITY, KOREA

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KEYWORDS: Infrared Thermography Testing, Digital Image Correlation(DIC), Digital Holography, Electronic Speckle Pattern Interferometry(ESPI), Shearography

1. INTRODUCTION

The research fields of automation laboratory, Chosun University, Korea, include Infrared Thermography Testing, Digital Image Correlation (DIC), Digital Holography, Electronic Speckle Pattern Interferometry (ESPI) and Shearography.

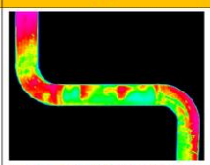
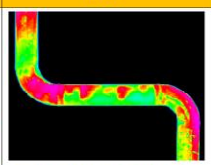
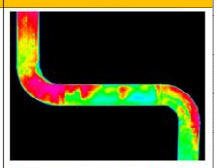
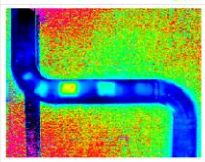
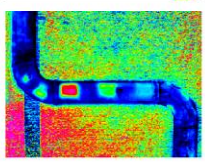
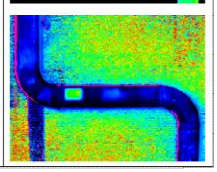
2. R&D ACTIVITIES

2.1 INFRARED THERMOGRAPHY TESTING

Infrared Thermography Testing under study in this laboratory uses IR Camera. A system for circulating water through heating or a system for circulating hydraulic fluid. This is done by applying a faulty pipe. It is aimed at various types of pipes such as straight pipes and curved pipes. Recently, nuclear piping has been intensively studied. Fig. 1 shows this setup. The defects were measured using the thermography and lock-in techniques. Respectively.

Fig. 1 Experimental IR setup for detecting inner defect of a pipe in the heating circulation system.

Table. 1 Results of defect detection using IR thermography.

Distance	1 m	1.5 m	2 m
Thermal Image			
Lock-in Image			

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2-2. DIGITAL IMAGE CORRELATION(DIC)

Digital Image Correlation is a non-contact measurement method that measures the displacement and strain using the correlation of images obtained before and after deformation of an object. We set up this digital image correlation to measure tensile stress, displacement and strain of tensile test specimens. Fig. 2 shows the DIC setup for measuring the tensile stress of the tensile test specimen. Fig. 3 shows the same point measurement with two cameras.

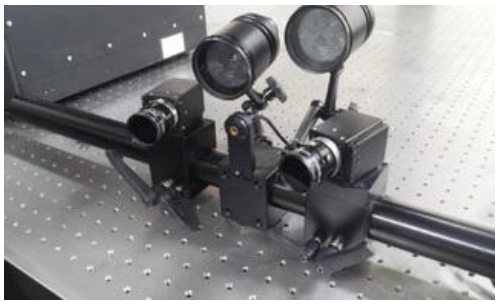

Fig. 2 Experimental DIC setup using stereo vision for measuring tensile stress on the standard tensile specimen.

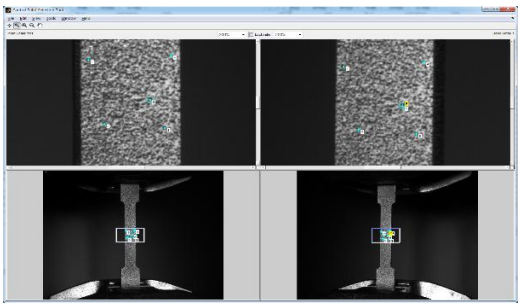

Fig. 3 Pattern comparison right and left image obtained two cameras by proper feature point selection.

2-3. DIGITAL HOLOGRAPHY

Transmission type and reflective type digital holography are applied to investigate the damage of thin film which is a transmissive type and reflection type respectively, honeycomb structure and illuminance. Fig. 4 is a reflection type digital holography setup using microscophy. The line width of the honeycomb structured circuit was measured. Table. 2 shows the results.

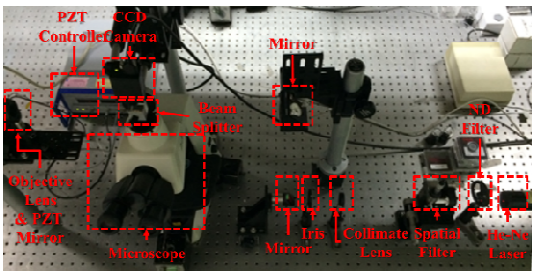

Fig. 4 Reflection type digital holography setup.

Table. 2 Result of line width by digital holography.

Measurement Point	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Average
Width[Unit: μm]	44.00	44.00	46.20	43.45	43.45	43.45	42.90	43.50	44.00	43.88

2-4. ELECTRONIC SPECKLE PATTERN INTERFEROMETRY(ESPI)

ESPI can be used to measure deformation. Recently, the residual stress of the welding specimen was measured. Fig. 5 shows the MTS tensile testing machine and the ESPI setup. Welding test specimens with welding currents of 140 A, 160 A and 180 A were subjected to tensile stress of 2 kN, 3 kN and 4 kN. Respectively.

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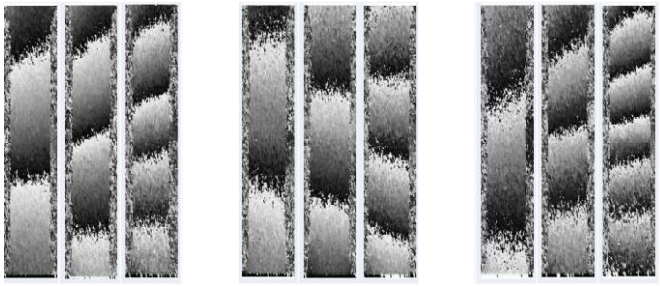
Fig. 5 Experimental ESPI setup for measuring residual stress on the welded specimen with MTS tensile testing machine.



2kN 3kN 4kN 2kN 3kN 4kN 2kN 3kN 4kN
(a) 140A (b) 160A (c) 180A

Fig. 6 Results of the residual stress measurement using ESPI with MTS tensile testing machine.

2-5. SHEAROGRPAHY

Shearography is used to measure the surface and internal defects of various composites. It is also possible to measure the internal defects of the pipe in the heating circulation system. Fig. Set up the shearography experiment as shown in Fig. The results of measuring pipes with internal defects by size are shown in Fig. Respectively.

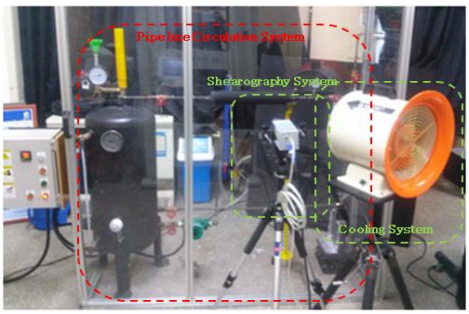


Fig. 7 Experimental Shearography setup for detecting inner defect of a pipe in heating circulation system.

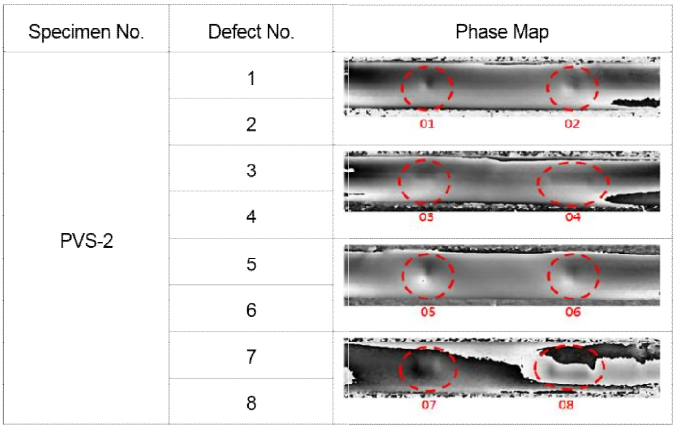


Fig. 8 Results of the inner defect detection of a pipe in heating circulation system using shearography and cooling system.

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