

# 가 ESPI

## Developing an ESPI system using a tunable diode laser

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Key words : Diode laser, Phase shifting method, Interferometry

### 1.

MEMS, LCD, Build-Up PCB  
가  
(optical triangulation), Moire  
Measuring Profilometer),  
Speckle Pattern Interferometer),

$$\phi(x, y, t) = 2\pi \Delta l / \lambda_0 - 2\pi (\Delta l / \lambda_0^2) \Delta \lambda = \phi_0 - \Delta \phi \quad (5)$$

$$\Delta \phi = 2\pi (\Delta l / \lambda_0^2) \beta \Delta i \quad (6)$$

(ESPI)  
ESPI  
3  
map)  
Trasducer)  
(Hysteresis error) 가  
PZT

$\Delta l$ ,  $\Delta i$ ,  $\lambda_0$   
(initial wavelength),  $\beta$ ,  $\phi_0$

(6) 4-frame  
( $\Delta \phi$ )  $\pi/2$

$$\Delta i = \frac{\Delta \phi \cdot \lambda_0^2}{2\pi \cdot \beta \cdot \Delta l} = \frac{\lambda_0^2}{4 \cdot \Delta l \cdot \beta} \quad (7)$$

가 (Phase  
PZT(Piezo-electronic  
Trasducer)  
가  
가

2  
intensity 가 가 4-frame  
(6)~(9)

### Modulating ESPI

가  
가  
PZT 가  
가 가  
가

$\phi$  (8) 가

$$\phi(x, y) = \tan^{-1} \frac{I_4(x, y) - I_2(x, y)}{I_1(x, y) - I_3(x, y)} \quad (8)$$

(8) arctan  $2\pi$   
(unwrapping) 가

### 2.

가 4-frame  
 $I_1(x, y) = a(x, y) + b(x, y) \cos \{ \phi(x, y) \}$  (1)  
 $I_2(x, y) = a(x, y) + b(x, y) \cos \{ \phi(x, y) + \Delta \phi \}$  (2)  
 $I_3(x, y) = a(x, y) + b(x, y) \cos \{ \phi(x, y) + 2\Delta \phi \}$  (3)  
 $I_4(x, y) = a(x, y) + b(x, y) \cos \{ \phi(x, y) + 3\Delta \phi \}$  (4)

PZT 가  
4-frame 가  
1/4 가  
가  
( $\Delta \phi$ )가  $\pi/2$  (1)~(4)  
(5)~(7)

### 3.

$\lambda_0 = 656.5nm$ ,  
30mW,  $\beta = 6.2 \times 10^{-3} nm/mA$  가  
Hitachi Image Processing  
LabVIEW 8.0  
가  
Laser Controller 25  
가 300mm, 160mm, 2mm  
(reference beam) (object beam)  
(speckle pattern)가 CCD Frame grabber  
PC, Laser Controller  
Out-of-Plane  
ESPI  
8cm (7)  $\Delta i$  0.21mA  
335

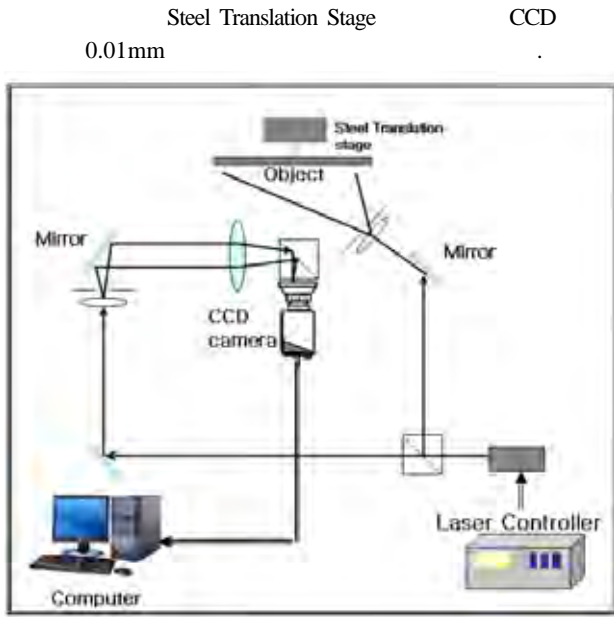


Fig 1. Schematic Setup of Out-of-Plane ESPI System

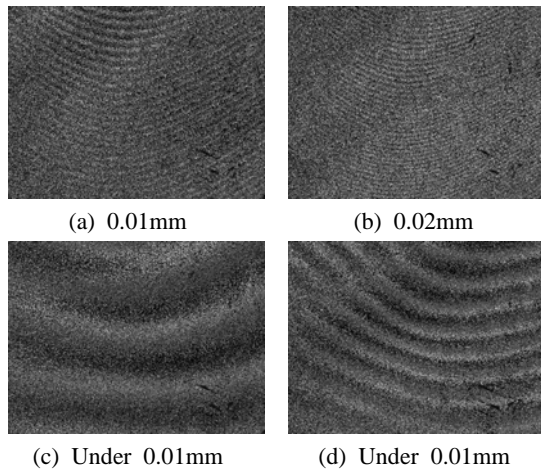


Fig 2. Result of Out-of-Plane ESPI

4.

PZT

ESPI  
ESPI

가

가

, Steel Translation Stage  
Fringe Pattern  
0.01mm

0.01mm

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