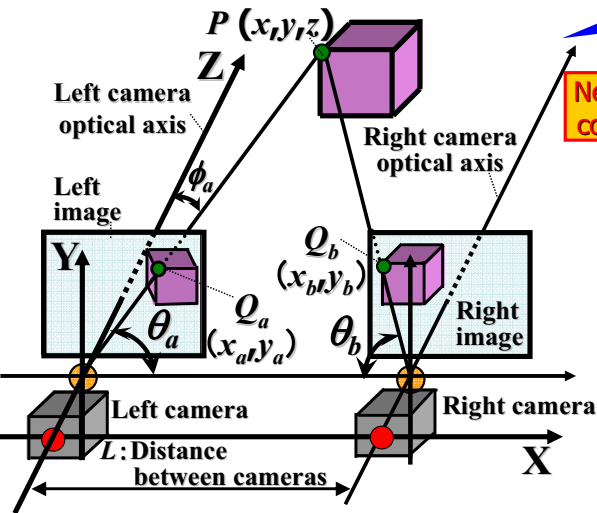




Objective

This study aims to **evaluate the measurement accuracy of the three-dimensional visualization measurement method using the near field stereo system based on the digital image correlation (DIC) method.**

Back ground

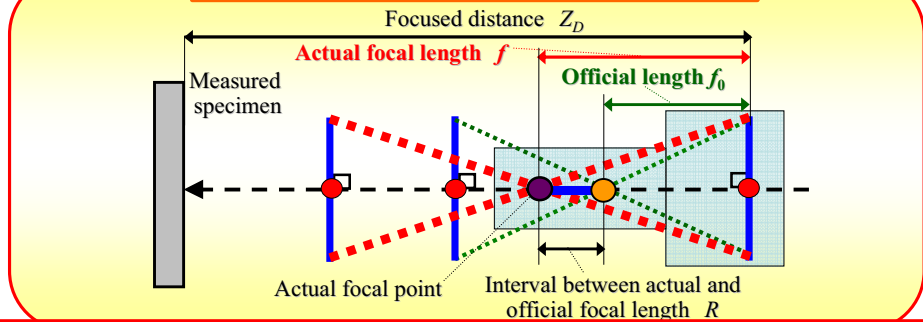


Principle of conventional stereo system can measure the three-dimensional visualization measurement in the far field.

Near field condition

Actual focal length is not equal to an official focal length, and the focal length is changed by focused distance in the near field.

Focusing mechanism at the near field



Necessity of three-dimensional visualization measurement in the near field has been grown for inspecting the small materials in the ministry space.

Principle of conventional stereo system

Approach

- ⊙ We propose a technique using the near field stereo system based on the DIC method.
- ⊙ We confirm the effectiveness of the proposed method at the near field three-dimensional visualization measurement.

Geometric proposed method

We formulate the theoretical flow to considering the points No.1 to 3.

No.1

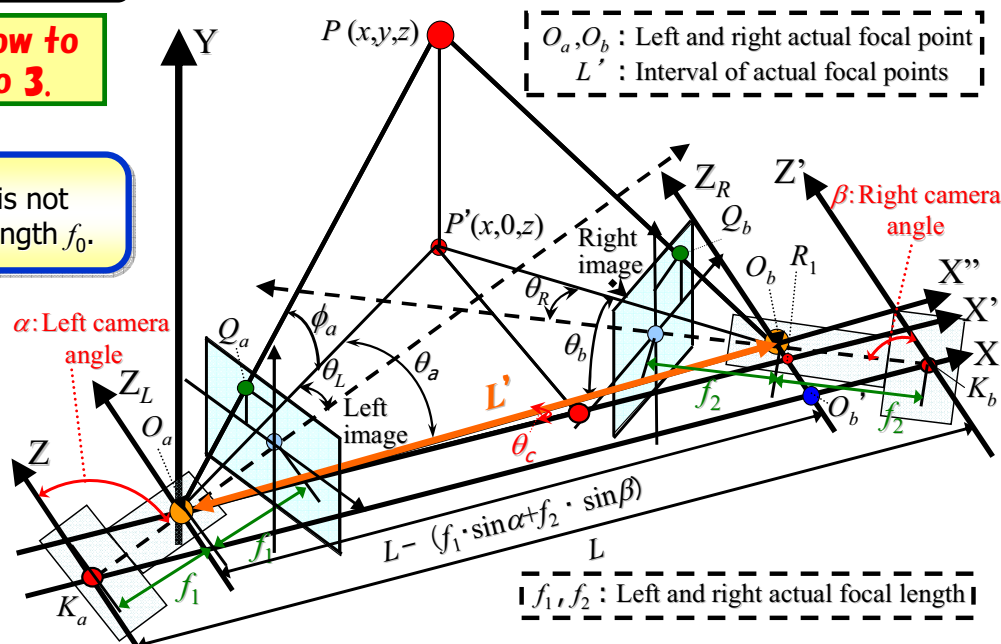
The actual focal length f in the near field is not equal to the commercially official focal length f_0 .

No.2

The actual focal point is changed due to the phenomena by the point No.1.

No.3

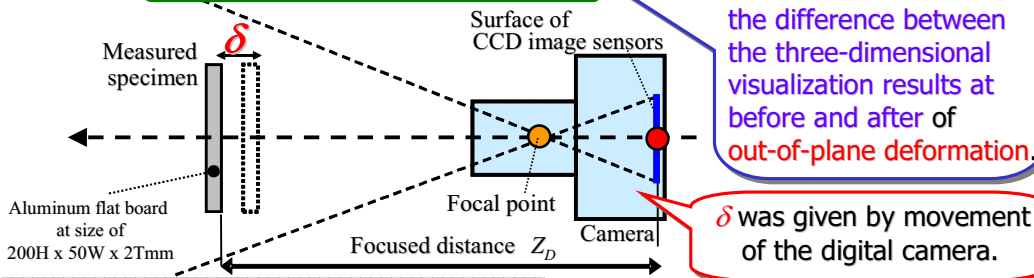
The optical axes of the left and right cameras are not parallel.



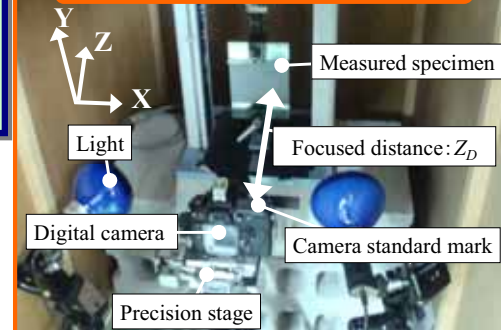
Experimental method

- ⊙ We evaluated the measurement accuracy of the three-dimensional visualization measurement by using both the official focal length f_0 and the actual focal length f .
- ⊙ We evaluated the three-dimensional visualization difference of out-of-plane deformation δ occurrence before and after.

Out-of-plane deformation δ



The experimental set up



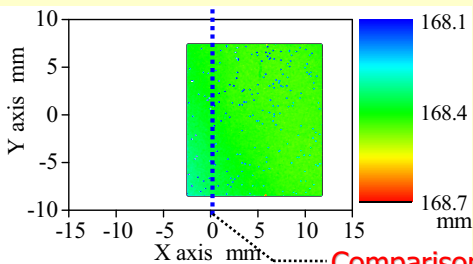
We photographed the left and right images by changing the positions of the digital camera.

Measurement results

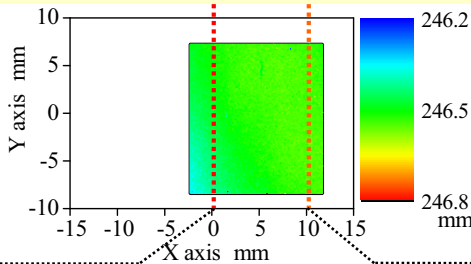
Effect of considering the actual focal length f on the measurement accuracy

Interval between cameras $L=10\text{mm}$

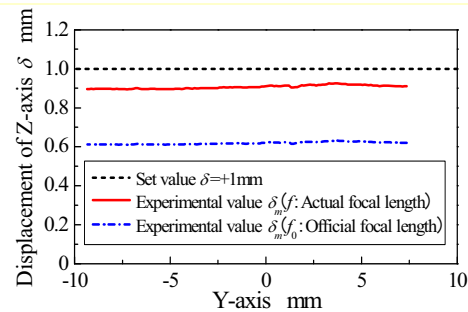
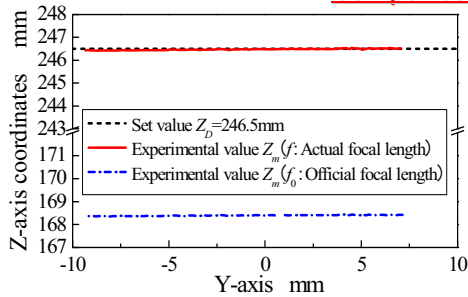
Principle of conventional method



Proposed method



Comparison



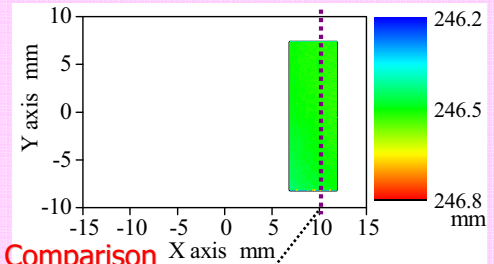
Experimental conditions

Number	1
Camera	Left Right
Focused distance Z_D [mm]	246.5
Official focal length f_0 [mm]	60
Actual focal length f [mm]	88.07
Interval between cameras L [mm]	10, 20
Angle of camera $[\circ]$	0
Size of 1pixel [mm]	10.96
Set value of out-of-plane deformation δ mm	+1

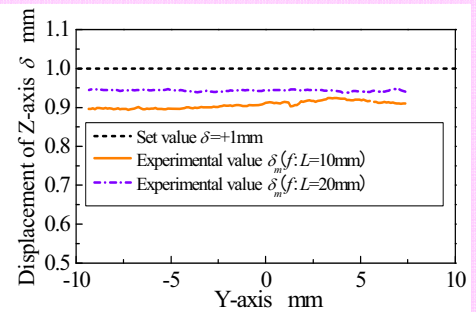
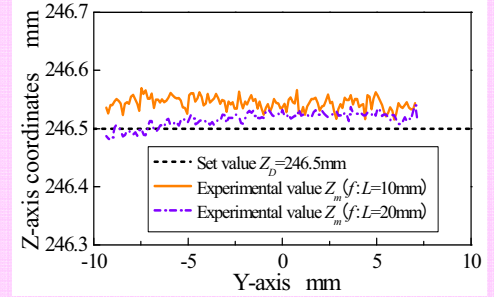
Effect of interval between cameras on the measurement accuracy

$L=20\text{mm}$

Proposed method



Comparison



Conclusion

The measurement accuracy, of not only the three-dimensional visualization but also the out-of-plane deformation value, with above the actual focal length f conclusion is improved as compared to one the official focal length f_0 conclusion.