Strain result comparison of a Strain Gauge and 3D DIC

Strain gauges have historically been used to analyze the strain in tensile testing. In recent years, the development of Digital Image Correlation has led to increase in its accuracy. Due to this development, it has become widely used as an optical method for analyzing material testing data.

In this case study, performed in collaboration with our distributor from Japan – NobbyTech – the difference between a contact strain gauge and a non-contact optical method is verified.

Advantages of DIC	Advantages of Strain Gauge
Non-contact	No speckle pattern required
Full-field strain and displacement mapping	Measurements are possible even in inaccessible places
Post-processing	
Different results (Principal Strain, Poisson's Ratio, shear strain, etc.)	
Displacement and strain distribution results	

Testing conditions:

In this case study, a tensile test on an aluminum sheet specimen was conducted, see Fig. 1. The dimensions of the specimen are 25 x 60 x 2 mm and the strain gauge was attached in the middle of the specimen. The machine was a Shimadzu Autograph testing machine.

Setup specifications:

Camera: Basler

Resolution: 2 472 x 2 064 (5 MP)

Lens: 25 mm (C-Mount)

Lighting: Halogen light (200 W)

Frame rate: 20 fps

Exposure time: 10 ms

Measurement location: red circle on Fig. 1.

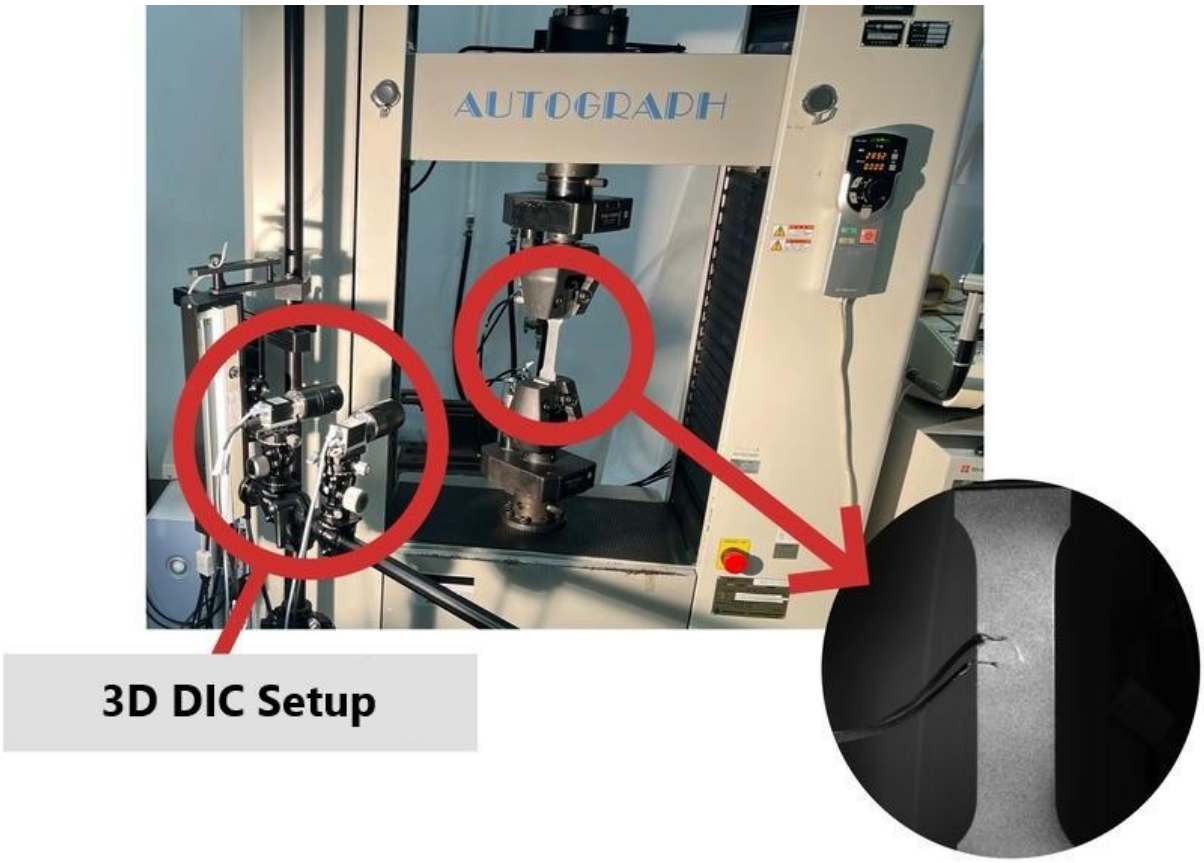


Fig. 1: Test setup

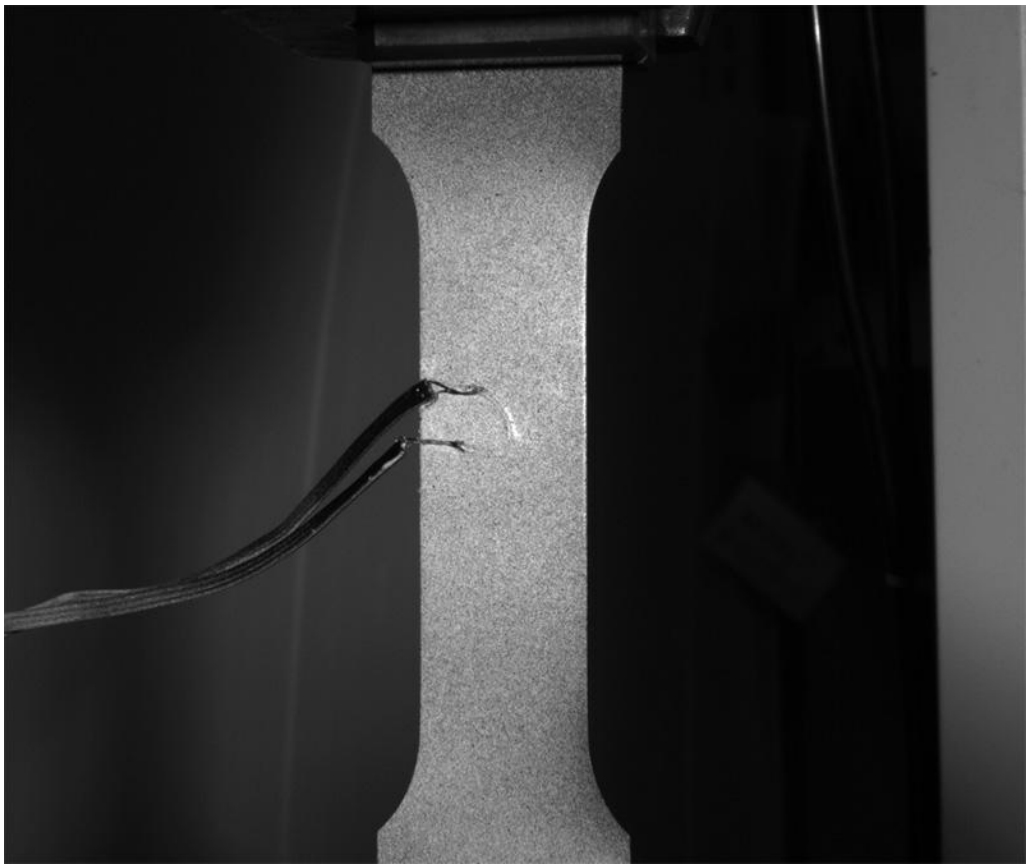
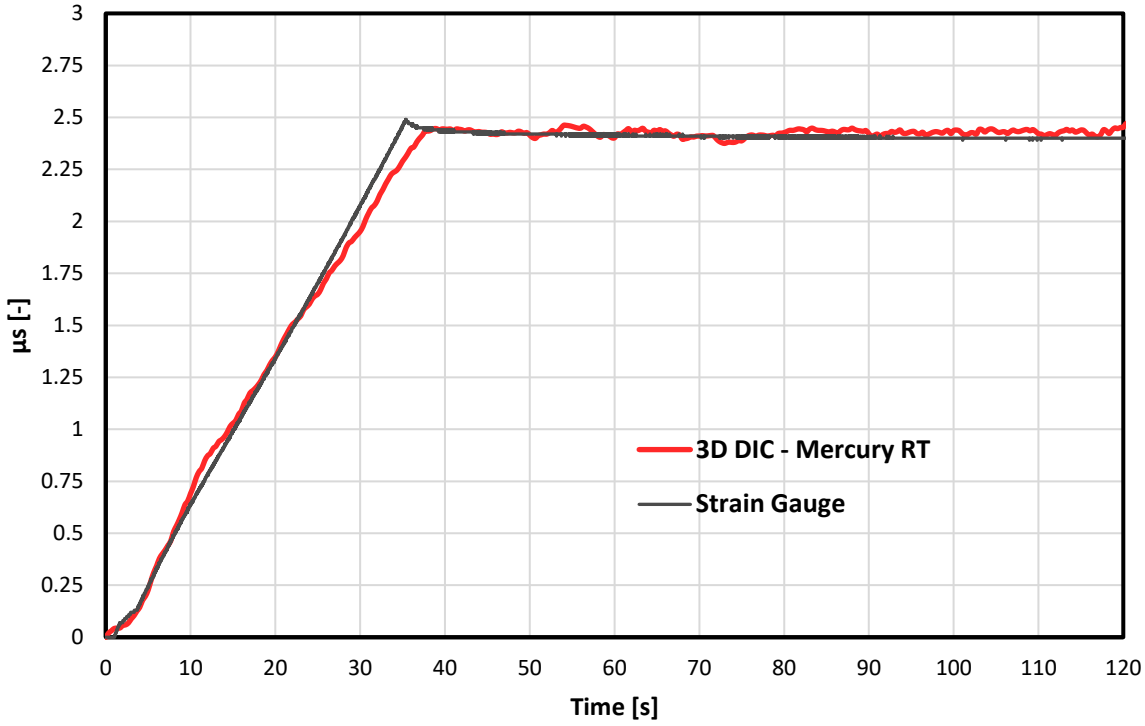


Fig. 2: Specimen detail

Results:

As seen on Fig. 3, the strain values obtained from a DIC analysis are close to the ones obtained by a Strain Gauge. To compare the data sets, the area under the curve using trapezoid rule was calculated. The data sets show an error of 2,116 % using this method.


3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
µs [-]
0
10
20
30
40
50
60
70
80
90
100
110
120
Time [s]
3D DIC - Mercury RT
Strain Gauge