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|  | Laboratory Exercise 2: Digital Image Correlation (DIC) Testing |
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# Introduction

The purpose of this report is to detail the Digital Image Correlation (DIC) testing conducted on the material DP800, using shear geometry. The following sections outline the preparation, execution, and analysis phases of the DIC process as per our lab activities dated April 25, 2024.

# Experimental methods

## 2.1 Material preparation

The specimen preparation was critical to ensure accurate DIC results. The surface of the DP800 material was meticulously cleaned using acetone to remove any contaminants. It was crucial that the middle part of the specimen, where DIC paint would be applied, was not touched post-cleaning to avoid any smudges or residues.

## 2.2 Painting process

For DIC analysis, the specimen must have a contrasting speckle pattern. Initially, a white base coat was applied to the cleaned surface. After drying the base coat, a black speckle pattern was added. This speckling process was refined through trial and error to achieve optimal brightness for the DIC equipment, ensuring clear differentiation between speckles. If the speckle quality was found to be inadequate, acetol was used to remove the paint, allowing for a redo of the painting process.

## 2.3 Equipment setup and calibration

The DIC setup involved the use of Vic Snap-9 for capturing images and Vic 3D for post-processing. Prior to image acquisition, the DIC machine and its surrounding black boxes — which serve to reduce external light interference — were warmed up. The calibration of the camera and alignment of the DIC system were checked using the crosshair function to ensure a discrepancy of no more than 4-5 pixels between views, which was considered acceptable for our tests.

## 2.4 Test execution

Specimens were mounted in the tensile testing machine (TestXpertII software used), ensuring they were aligned perfectly both vertically and horizontally using a perpendicular tool. During the test, we employed different preload values depending on the specimen geometry and expected breakage point, ensuring minimal unwanted data from movements or vibrations. For example, for SDB DP800 the preload was set around 15 MPa, whereas for SHS, it was adjusted to 30 Newton due to its lower breakage threshold.

## 2.5 Data Acquisition and Analysis

The DIC system was used to capture changes in the specimen as it underwent tension. The DIC recorded speckle images which allowed for calculation of displacement (delta\_L) and strain. These measurements, combined with the force data obtained from the tensile machine, facilitated the computation of both engineering and true stress-strain curves. The tensile test was continued until the specimen fractured, and DIC images were taken throughout the process to monitor the material behavior under stress.

# Results

Using Vic 3D software, the captured data was further analyzed to produce detailed stress-strain curves and other relevant mechanical properties of the material. The data analysis focused on extracting meaningful insights from variations in geometry (SDB, SHS) and directions (RD, TD, DD), ensuring a comprehensive understanding of the material’s mechanical responses.

# Discussion

The DIC testing for DP800 material was conducted meticulously, following rigorous procedures for specimen preparation, equipment calibration, and data acquisition. The detailed speckle pattern, careful calibration, and synchronized data collection enabled the accurate depiction of the material’s deformation under stress, leading to valuable insights into its mechanical properties. This methodical approach ensures repeatability and reliability in our material testing processes.

# Conclusion

# References

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## Appendix