Structured light vs Digital Image Correlation for shape measurements

Budiakivska D.*, Styk A. and Kujawińska M.

Institute of Micromechanics and Photonics, Warsaw University of Technology, Warsaw, Poland
e-mail: daryna.budiakivska.dokt@pw.edu.pl

KEYWORDS: *Digital Image Correlation, Structured Light, Shape Measurement, Subset Size.*

The structured light (SL) method is currently one of the most widely used techniques for accurate shape measurement in industry, medicine, and cultural heritage applications [1]. However, when displacement and strain measurements are also required, for example in structural integrity monitoring, 3D digital image correlation (3D DIC) is often preferred. In 3D DIC, all relevant quantities – namely 3D shape as well as displacement and strain fields – can be obtained using a relatively simple measurement setup consisting of only two cameras [2].

It should be noted, however, that successful application of 3D DIC requires the presence of a sufficiently random surface texture (either natural or artificially applied), and the subset selection strongly depends on the quality of this texture. Therefore, the aim of this work is to provide practical guidance on whether, and under what conditions, the accuracy of shape reconstruction using 3D DIC can be comparable to that achieved by the structured light method, which is here treated as a reference (SL measurements done with Smarttech3D MICRON3D scanner). In particular, we investigate how the choice of subset size affects the reconstruction accuracy.

To evaluate the influence of 3D DIC parameters on the recovery of both global and local geometric features, we analyse several objects with different spatial frequency content, including a technical sample (wire arc additive manufacturing (WAAM) specimen), a cup (both with artificial texture), and an oil painting (with natural texture). Example results illustrating the influence of subset size on the shape measurement of the WAAM specimen are presented in Fig. 1.

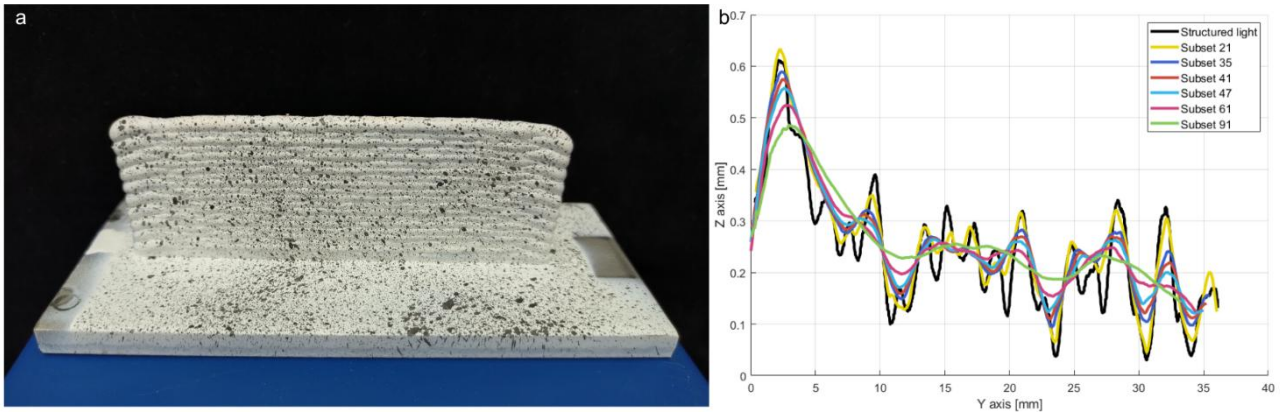

Figure 1. a) WAAM specimen used for shape measurements, b) cross-section of WAAM specimen with SL compared to different subsets of DIC.

ACKNOWLEDGEMENT: This work was partly supported by 23IND08 DI-Vision grant by European Partnership on Metrology.

[1] J. Xu, S. Zhang, Status, challenges, and future perspectives of fringe projection profilometry. Opt. Lasers Eng. 2020, 135, 106193.

[2] M. Sutton, J. Orteu, H. Schreier, Image Correlation for Shape, Motion and Deformation Measurements. Basic Concepts, Theory and Applications, 2009. 10.1007/978-0-387-78747-3.