THESIS PROPOSAL

Reference: S. Cacace, Professor Q. Semeraro

Subject: Study on the dimensional accuracy of X-ray Computed Tomography for small features

Date: May 2021

The objective of the work is to build a test object to simulate internal porosity and test the accuracy of the XCT measurement. Repeatability and reproducibility of the XCT system should be investigated as well as the influence of the internal defects position and size on the measurement error.
This work is justified by the widespread use of XCT systems to characterized internal porosity in Additive Manufacturing parts. Defects in AM are usually around 15 to 200 μm in size. A reference object was already designed by a previous student and it was composed by a 3D printed PLA case in which 4 aluminum disks where placed one over the other. On the top surface of each disk 36 featured were micro-drilled.

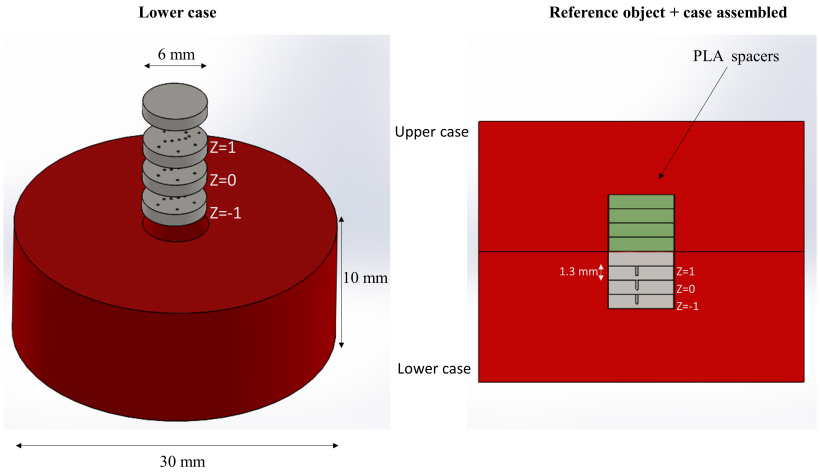

Figure 1: Previously designed reference object

In this thesis the student will re-design the reference object to improve repeatability and reproducibility of the object itself and will carry out the XCT measurements as well as the data analysis. This thesis is a combiantion of hardware and software. The hardware part consists in the design and production of the reference object based on previous tesi work of other students. The software part will cover the image analysis from the output of XCT system. The softwares used are Matlab and VGStudioMax (a software for image analysis dedicated to XCT data).

Starting date: To be decided with the professors.

Required Knowledge: Basics of Matlab coding, Design and Analysis of the experiments course

Bibliography

Cacace, Stefania, Simone Giacomazzi, and Quirico Semeraro. "Estimation of the accuracy of measurement of internal defects in X-ray Computed Tomography." Procedia CIRP 99 (2021): 284-289.

Nikishkov Y, Airoldi L, and Makeev A. Measurement of voids in composites by X-ray Computed Tomography. Composites Science and Technology. 2013; 89: 89-97.

Jansson A, Zekavat AR, and Pejryd L. Measurement of internal features in additive manufactured components by the use of computed tomography. In Digital Industrial Radiology and Computed Tomography (DIR 2015), Ghent, Belgium, June 22-25, 2015. German Society for Non-Destructive Testing.

Hermanek P, Carmignato S. Reference object for evaluating the accuracy of porosity measurements by X-ray computed tomography. Case studies in nondestructive testing and evaluation. 2016; 6:122-7.

Hermanek P, Carmignato S. Porosity measurements by X-ray computed tomography: Accuracy evaluation using a calibrated object. Precision Engineering. 2017; 49:377-87