Influence of Surface Determination in Coordinate Metrology on Additively Manufactured Assemblies using X-ray Computed Tomography

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Abstract

Additive manufacturing (AM) is increasingly adopted for industrial applications thanks to its ability to produce complex shapes, reduce material waste, and allow high levels of customization. As the interest and the demand for AM components grows, X-ray Computed Tomography (XCT) becomes a powerful non-destructive tool for geometrical metrology, particularly suitable for inspecting internal features of AM parts that are inaccessible with traditional techniques.

Despite its potential, the XCT process involves multiple steps and each of these steps adds uncertainty to the final result, affecting the reliability of the final measurement. Among these, surface determination plays an important role. It defines the surface points of the object within the volume data, directly influencing the accuracy of target measurands.

This study aims to assess the capability of XCT-based measurements, comparing different surface determination techniques from the literature and commercial XCT software tools. The evaluation is performed on a metal artifact designed to replicate internal features found in additively manufactured parts. The artifact consists of assembled components produced by AM, mimicking internal geometries and allowing a comprehensive analysis of the performances of surface determination and its influence on measurement results, contributing to improved traceability in XCT-based metrology. Calibration results coming from coordinate measuring machine (CMM) are considered as a reference.