Joint Special Interest Group meeting between euspen and ASPE
Advancing Precision in Additive Manufacturing
KU Leuven, Belgium, September 2023
www.euspen.eu

Application of discrete Legendre polynomials for geometrical measurements of additive manufacturing parts using computed tomography

R. Santander[1,2], H. Haitjema[1], M. Janssens[2], W. Dewulf [1]

[1]Department of Mechanical – KU Leuven
[2]Materialise NV

ricardosantiago.santandercardenas@kuleuven.be

Abstract

Determining the roughness of additive manufacturing objects is widely acknowledged as a complex task. This paper therefore presents a practical application of discrete Legendre polynomials in extracting geometrical measurements from Laser sintered material using X-Ray Computed Tomography (XCT).

X-Ray Computed Tomography (XCT) is first utilized to export the surface of an additive manufacturing (AM) object into voxel data. Subsequently, a segmentation process employing deep learning techniques is performed to accurately extract the XYZ coordinates of the AM shape. These coordinates are then treated as a standard roundness form by filtering out higher-frequency noise and standardizing them based on undulation per revolution (UPR). This approach allows us to effectively extract the profile of the surface for in-depth analysis.

To mitigate the effects of tilt, decentering, and cylindrical form in the surface analysis of additive manufacturing (AM) objects, we apply the Legendre-Fourier transform. This enables us to perform a precise 'roughness' filtering specifically tailored to the CT slices corresponding to a single layer of the AM object. The method moreover allows to overcome the inherent challenges associated with assessing AM object roughness, such as undercuts.