A Novel Surface Characterisation Strategy for the X-ray Computed Tomography Measurement of Complex Additively Manufactured Parts

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Abstract

X-ray Computed Tomography (XCT) has the advantage over the traditional tactile and optical measurement systems in that it is the only valid non-destructive method to measure both external and internal geometries of complex functional parts, e.g. additively manufactured (AM) parts, whose intricate shape does not allow line-of-sight. However the XCT measurement posts many challenges to surface texture assessment of AM parts. One of the big issues is that XCT generated measurement data structures, i.e. point cloud and triangular mesh, are not straightforward compatible with the standard surface texture characterisation, which requires uniform sampled grid structure and also requires measured surface to be basically planar. This work proposes a novel strategy that the surface filtration and roughness parameterisation techniques can deal with triangular mesh. Based on the link between the Gaussian cutoff wavelength and the diffusion time, the proposed linear diffusion equation can achieve a Gaussian filtering effect on complex surfaces. Also the areal surface texture height parameters are extended to triangular mesh. With these two enhancements, it contributes to the solution to using XCT for a holistic and reliable measurement of surface texture of complex AM products.