

## Diffusion Filter for 3D Freeform Surface Characterisation

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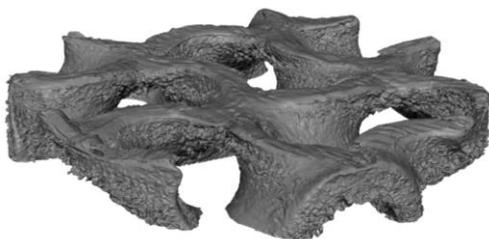
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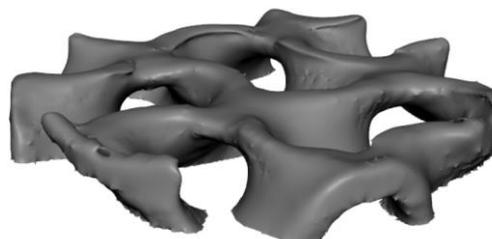
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### Abstract

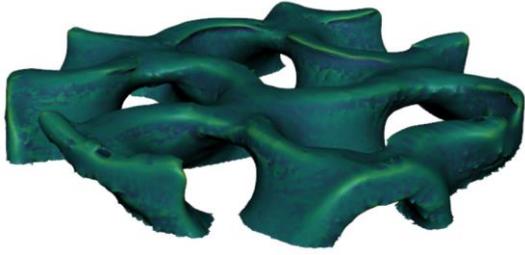
Conventional areal surface characterisation, including association, filtration and surface parameter, are all based on 2.5D lattice grid data. With the development of new manufacturing techniques, especially additive manufacturing, parts with extremely complex freeform surfaces can now be manufactured to fulfil more complicated functional requirements. These types of surfaces, which cannot be described using Euclidean-space (such as the lattice grid) based method, are usually measured by a non-conventional surface instrument, such as 3D cameras, laser trackers, and X-ray computed tomography. The measurement data is represented by a polygon mesh. In our previous research, a general framework, along with the fitting methods and true 3D surface field parameters, including height, spatial and hybrid parameters, have been developed. For a surface with known geometry, a fitting method can be used to separate the form/geometry from the surface texture. While in most cases, surface geometry is unknown, then how to separate the geometry and the surface texture for further evaluation of the geometry/dimensions and surface roughness remains a big challenge. This research is to report a novel 3D triangle-mesh surface filtration for the separation of the reference form and the surface roughness. By applying the diffusion process on the measured triangle-mesh iteratively, a smoothing version of triangle-mesh can be generated, which can be used as the reference form for the geometry/dimension evaluation. And then, by orthogonally projecting the measured vertex onto the smoothed mesh, the distance between them can be regarded as the residual (surface roughness). Our initial results show the proposed method is and promising way for 3D freeform filtration.



(a)



(b)



(c)

Figure 1: A AM lattice strut measured by XCT : (a) original mesh surface; (b) filtered reference mesh surface; (c) residual/roughness representation