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Towards a new definition of areal surface texture parameters on freeform surface

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Abstract

Current definitions and computation of areal surface texture parameters are based on planar, measured or unwrapped, surface which is not applicable for non planar irregular meshes. In this paper an extension of areal surface texture parameters (height and hybrid parameters) for freeform surface is proposed. The proposed method can be used for both general and complex surfaces and it works well on surfaces where there are undercuts and non uniformly spaced points. The proposed method has been tested on six sets of different types of surfaces and the computed parameter results were compared with the values of the parameters defined in ISO 25178-2:2012.

Keywords: Freeform surface characterisation, Areal texture parameters, Surface reconstruction, Parametric surface

1. Introduction

Nowadays advanced manufacturing technologies empower complicated geometries to be designed and manufactured. For example additive manufacturing (AM) allows internal and external components with freeform geometries to be manufactured. This has led to a series of challenges in characterisation of complex surfaces. One challenge is the measurement of complex surfaces and the follow-on is the characterisation of the measured surface. While computed tomography (CT) has been considered as one of the promising measurement systems for certain complex surfaces (subject to its material), extracting surface information from CT measurement is an imperative operation.

To perform such extraction, the first necessary step is the reconstruction from volume to mesh that can produce an adaptive meshing based on the maximum allowable distance between the implicit function (surface with constant grey value) and the final triangular mesh [4]. A bonus of such operation is that the extracted mesh allows re-entrant features (undercuts). However one cannot directly compute areal surface texture parameters from such extracted mesh.

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