3rd Dimensional X-ray Computed Tomography Conference

2nd – 3rd July 2018
University of Nottingham

Internal surface measurement by X-ray computed tomography: an additive manufacturing industrial case study

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Abstract

Additive manufacturing (AM) processes have been lauded for their ability to produce highly complex geometries that are otherwise not manufacturable. This includes lattice structures and internal cooling channels. Such structures may have a revolutionary impact on the aerospace, automotive and medical sectors because of their associated functional properties; for example, significant savings in weight, impact energy absorption, vibration isolation and thermal management. However, such structures present issues in verification, as crucial surface features are often difficult-to-access or entirely separated from the outside, and so cannot be measured by established optical or contact methods. Recent work has demonstrated the feasibility of X-ray computed tomography (XCT) for the measurement of internal and hard-to-access surfaces. Using designed-for-purpose separable assemblies, pseudo-internal surfaces have been investigated by comparison of XCT data to that acquired using established measurement technologies. Here, we present a case study of an XCT surface measurement, using an industrially representative sample comprising a metal AM Ti6Al4V cube of (20 × 20 × 20) mm containing internal channels. The cube will be measured by XCT at two different magnification settings and assessments of internal surfaces made based on the resulting data (see figure 1). The cube will then be sectioned in order to perform measurements by conventional techniques and comparisons of direct topographies as well as generated ISO 25178-2 parameters will be made between datasets.

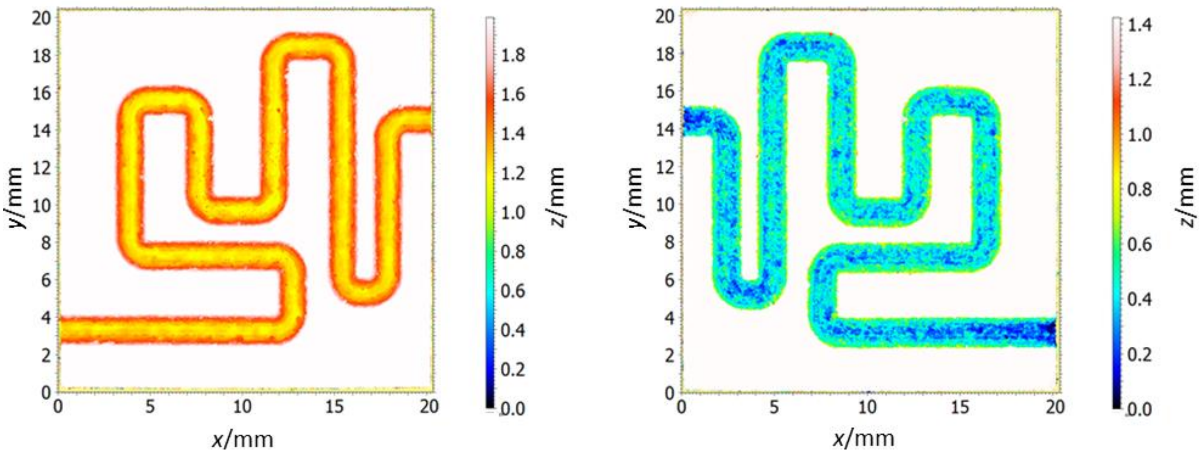

Figure 1. Top and bottom of measured channel, extracted from XCT data.