Conformal cooling channels are becoming one of the next big steps in the fabrication of moulds and tools. Mass flow rate and heat transfer are affected by the surface roughness in the cooling channels. The freeform shape of conformal cooling channels makes it difficult to evaluate the internal roughness with respect to classic planar techniques. This work presents a fitted-ellipse method to evaluate internal surface features of helical cooling channels. The investigated cooling channel was made from maraging steel 300 and manufactured with the selective laser melting process. X-ray computed tomography and image analysis were utilized in order to generate a freeform nominal surface by fitting ellipses to the reconstructed surface. The nominal surface was compared to the reconstructed surface and resulted in a point cloud of deviation values. The deviation values were used as input for deviation plots, inner area and volume estimations together with estimations of classic area surface parameters, according to ISO 25178-2:2012. Results showed that the internal surface features were highly orientation dependent, with extreme roughness observed on the downward facing surface of the cooling channel. The arithmetical mean height and average maximum height of the total inner surface were estimated at $S_a = 13.7 \, \mu m$ and $S_{z20} = 251 \, \mu m$, respectively. The mass distribution was positively skewed, the root mean square height was $S_q = 21.8 \, \mu m$ and the peaks observed on the surface were characterized as spiked. The obtained results suggested that the proposed method could evaluate the internal features of a helical cooling channel efficiently and qualitatively, while giving realistic quantitative estimations of the surface roughness characteristics.

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