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Enhancing the dimensional accuracy of a low-cost 3D printer

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3D printing is widely used in the entertainment industry by filmmakers, effect studios and game designers to easily and fast fabricate characters or objects that are first virtually modelled through Computer Graphics. There are several commercial proposals in the field of low-cost 3D printers, with prices starting from a few hundred euros for kits that the users should assemble by themselves. However, their performances in terms of part accuracy are quite limited and are basically the consequence of a lack of optimization both in mechanical terms as in software.

Starting from these considerations, an optimization project was assigned to the students of the Specializing Master in Industrial Automation of the Politecnico di Torino. The Master is developed in collaboration with COMAU S.p.a., a company worldwide leader in automation expecially for the automotive sector. The task of enhancing the performances of the 3D printer Prusa i3, that is supplied in the assembly box, was assigned to sixteen engineers attending the Master who were divided into 4 groups. The activities have led to the birth of four new 3D printers: Fluo, Ghost, Metallica and Print-Doh.

In order to assess and validate the improvements, a benchmarking activity was carried out to evaluate the dimensional accuracy of the four printers. The benchmarking was based on the manufacturing of an innovative reference artifact whose geometrical features are designed to fit within different ISO basic sizes. Each group printed a replica of the reference part with their own new printer and then the replicas were measured by means of a coordinate measuring machine (CMM). Measures were used to compare the performances of the four printers and the results of the benchmarking considers the dimensional accuracy of the replicas in terms of ISO IT grades, but also the form errors of the geometrical features through GD&T tolerances.

Biography

Paolo Minetola is Associate Professor at the Department of Management and Production Engineering (DIGEP) of the Politecnico di Torino, Italy. His research intersests include 3D printing, additive manufacturing (AM), 3D scanning, reverse engineering (RE) and metrology. He is author and coauthor of over 40 paper published in national and international conference proceedings and scientific journals. In 2015, he has won the first prize of "The Cubesat Challenge", a design challenge promoted and sponsored by Stratasys Vertical Solutions – Aerospace about the optimization for additive manufacturing of the structure of small research satellites.

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