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A Comparison between Discrete and Continuous Scanning with Conoscopic Holography

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Abstract

Low density digitizing is a suitable approach for verification distances between pairs of machined flat surfaces. When defining a digitizing procedure of this type of features, two approaches could be applied: discrete or continuous scanning. Discrete Scanning (D) is performed with a static sensor, but the information for each single measurement comes from a constrained area. On the other hand, since Continuous Scanning (C) is carried out with a moving sensor, the information for each single measurement comes from a swept area. In this work, a comparison between these two approaches, when digitizing with a Conoscopic Holography sensor, is performed. The main objective is to establish their influence upon surface reconstruction quality and, thereafter, upon measurement reliability.

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Keywords: Conoscopic Holography; scanning; reliability.

1. Introduction

Tasks involving inspection and/or verification of manufactured parts are becoming increasingly important in modern highly-competitive markets, where product quality and cost reduction show up as key issues. Under these circumstances, non-contact measuring systems have become of great importance in the field of quality control,

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6. Conclusions

Performance of a CMM-integrated conoscopic sensor has been evaluated under two alternative digitizing procedures: discrete and continuous digitizing. Both approaches have been compared in the particular case of the verification of 3D distance between flat surfaces, since repeatability and trueness were calculated through long-lasting experimental runs. Additional reference values have been obtained with a touch-probe sensor and the CMM.

Regarding repeatability, it can be concluded that both procedures are equivalent under equivalent digitizing conditions (Exposition Length) for an identical number of digitized points, since standard deviation values of 3D measured distance are similar (C_{LD} and D_{LD} methods).

On the other hand, considering the assumed-as-true reference value for the 3D distance obtained with the touch-probe, significant differences had been found between different methods (C_{LD} and D_{LD}). This result is caused by actual differences between the points used in each method, regarding either actual position of points or differences in the information in each method. No influence can be regarded to a possible lack of normality in the experimental runs, as normality it has been confirmed by a Ryan-Joiner test.

The main conclusion of this research is that the continuous digitizing high-density method (C_{HD}) should be used when possible, since it provides higher speed and best comparative accuracy (precision plus trueness) under given test conditions. In those cases where, due to the nature or characteristics of the machine, could not be used, our recommendation is to choose the discrete digitizing high-density method (D_{HD}).

Future works in this field will focus on analyzing the influence of variations in test conditions (such as surface orientation, roughness or exposure length) upon the recommended method.

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