A Comparison between Discrete and Continuous Scanning with Conoscopic Holography

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ABSTRACT

Low density digitizing is a suitable approach for verification of 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.

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, because they allow to reduce inspection times, whereas accomplishing similar accuracies to those of traditional contact systems.

Contact measurement systems are undoubtedly the most used for verification and measurement tasks. A huge research effort has been carried out on these systems, which has led to a wide knowledge on their behaviour under different conditions. Research works in this field comprehend not only the degree of influence of internal sensor structure upon instrument accuracy [1], but also the influence of parameters regarding surface characteristics (like roughness or rigidity) of the measured surface [2]. Conversely, research effort has been less intense in the field of contactless systems and, specially, in those emerging or less-spread technologies. This is the case of the Holographic Conoscopy [3] technology, a type of interferometric technique with interesting capabilities, since few studies have dealt with its performance in industrial verification tasks [4, 5].

Present work will attempt to assess the capability of a conoscopic system for verifying the distance between two parallel flat surfaces. Results will be compared with those obtained by contact, which will be taken as reference. The sensor used in this work has been integrated in a Coordinate Measurement Machine (CMM), which enables both contact and contactless measurements (using Conoscopic Holography) on the same machine. Furthermore, this type of integration allows two types of measurement procedures: Discrete digitizing (D) and Continuous digitizing (C). C procedure allows for a higher digitizing speed, when compared with D. This capacity lead to collecting a higher number of surface points during equivalent periods of time, which means that a higher density of points could be obtained without increasing inspection time. It is well-known that the number of captured points and their distribution influences the measurement results, and affect calculation of parameters such as flatness or cylindricity [6-8]. In present work, density of points has also been taken into account during the evaluation of measurement system performance.