ExactScan

Using an Image Field Calibration Set

Integra Services
Application Update

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Business Development

Introduction

General Scanning Inc. includes as part of their 3 dimensional laser scanning system a 9-point correction utility that for most applications is sufficient to correct inherent distortion observed in the image field. It is not acceptable for use in the Rapid Prototyping industry where small feature size and dimensional accuracy is critical. A superior correction process has been developed by Integra Services International specifically to address the demanding requirements of the RP industry where GSI scanning systems are used.

Application Overview-How it Works

There is generally a certain amount of distortion of the image field in any X-Y laser scan system with two pivoted swiveling mirrors. A pin cushion deviation is natural when the rotational control system of the scanner is super imposed on the X-Y plane of the part bed.

GSI's HPLK hardware provides a method to compensate for these distortions at every point in the image field with the help of a correction table. For calculating this correction table, it is necessary to determine the distortions of the image field as exactly as possible. These distortions generally have various causes that can only be partially determined by applying the theory of operation. To achieve optimal image field correction, the occurring distortions can only be ascertained through experimentation.

The ExactScan Image Field Calibration Set allows us to measure the actual distortions in the respective laser scan system quickly and precisely. For that purpose, a test pattern can be imaged with the laser scan system. This test image will then be digitally captured with the help of a flatbed scanner. A program developed specifically for this is used to process the data and calculate an optimized correction table for the individual system.

Principle of Operation

Calibration of the scan system consists of the following steps:

1. A test pattern is imaged on the part bed in the shape of a 15.488 inch square dot pattern (65x65) using the laser scan system. A platform dependant precalculated correction table is used to create the test image.
2. The test image is captured with the help of a flatbed scanner creating a digital file used for later processing. Capturing the test image without the need to cut it into smaller pieces eliminates any potential error caused by stitching the smaller images back together.
3. Possible occurring inaccuracies of the flatbed scanner will be compensated for via a daily comparison with a glass reference grid. The resulting output file will contain only the actual error measured from the test image.
4. The ExactScan program processes the image data using a digital master square dot pattern of 180x180 as the reference grid. The program determines a regression polynomial function with the help of a least-squares-fit from the positions of the dots on the test image.
5. Finally, an optimized image field correction table is calculated using this polynomial function and converted to GSI format. The Z-axis calibration data is copied from the precalculated correction file used in step one.

Application Benefits-Results

The ExactScan calibration set is intended to be a single cycle calibration routine. This means that in most cases ExactScan can correct the positional accuracy of the individual scan system to the desired result with the first corrected table. The typical average error in X and Y is less than or equal to +/- .00025 inches over the entire image area of 15.448 inches square. The maximum error for any single data point is less than or equal to +/-.0025 and is outside of the part bed maximum dimensions of 15x13 inches.
With ExactScan, scale factors used to adjust for part shrinkage are much easier to calculate and use because of the overall squareness of the corrected part bed. Parts produced off axis are also much more dimensionally accurate and predictable.

Summary

The ExactScan Image Field Calibration Set is an application specific calibration process developed to substantially improve the accuracy of RP systems using GSI scanners. The ease of generating the test image allows the customer to produce the image without an on-site technical visit, making it more economical for the customer to verify calibration as often as every month. Low volume manufactures who require high QC standards will benefit from this technology by maintaining system accuracy to much tighter tolerances.

About Integra Services International

Integra Services International, Inc. is a provider of hardware service and application support to the Rapid Prototyping market. Integra is focused exclusively on developing service and product solutions that meet or exceed the exacting requirements of the industry.

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