Association for Coordinate Metrology Canada

Association canadienne de métrologie de coordonnées

2008 ACMC Annual Workshop
Windsor, Ontario Canada
26-27 June 2008

AGENDA: Thursday, 26 June 2008

08:30 - 08:50 CONFERENCE REGISTRATION
Continental Breakfast

08:50 - 09:00 Welcoming Remarks
Professor Waguih ElMaraghy, Head of the Industrial and Manufacturing Systems Engineering Department, University of Windsor

Dr. Greg Hetland, ACMC Chairman,

09:00 - 09:45 New Developments in US and ISO CMM Standards Abstract
Dr. Steven D. Phillips, National Institute of Standards and Technology, Gaithersburg MD, USA

Abstract: For the last 14 years the United States ASME B89.4.1 standard and the International ISO 10360 standard have coexisted as CMM performance evaluation procedures. Since 2000 an extensive effort to revise both standards has been undertaken and the results of that effort are now being finalized for publication. The revised ISO standard is much more metrologically extensive and rigorous than its predecessor. The US standard has, for the first time, been harmonized with its ISO counterpart. This presentation will discuss these recent developments in CMM standardization

09:45 - 10:25 Task Specific Error Correction in Coordinate Metrology – The PAMS Method
Kostadin Doytchinov and Jim Pekelsky, NRC, Canada
Presented by Kostadin Doytchinov

Abstract: The proposed method is a complete procedure for a task specific systematic error correction of CMMs (CMS) based on a calibration of a master part for a specific measurement task. The method is capable of removing all of the systematic errors caused by the operator, the environment or the measuring equipment. It creates an unique opportunity for industry to receive direct and complete traceability (method and measurements) for any real measurand instead of trying to apply corrections and estimate uncertainties based on the traditional artifacts such as ball plates, rings, plugs, gauge blocks, etc. The method is based on the well known comparator principle and the ISO 15530-3 standard "Geometrical Product Specifications (GPS) -- Coordinate measuring machines (CMM): Technique for determining the uncertainty of measurement -- Part 3: Use of calibrated workpieces or standards". The implementation can be fully automatic and will not require any significant effort or additional knowledge from the CMM operator and will satisfy any quality control auditor.

10:25 - 10:45 COFFEE BREAK - VENDOR TIME

10:45 - 11:30 Simplified uncertainty estimation for CMM measurements
Dr. Henrik S. Nielsen, HN Metrology Consulting, Inc., USA

Abstract: The lack of standards for CMM calibration poses a challenge for users both in terms of determining what constitutes traceability for CMM measurement and estimating the uncertainty of such measurements. However, it turns out that the information that is collected through the application of the tests given in performance evaluation standards, such as the US ASME B89.4.1 standard and the ISO 10360 standard series can be used to create a simplified uncertainty estimate for CMM measurements and can form the basis for a reasonable claim of traceability. This approach to uncertainty estimation has been validated through proficiency testing amongst accredited laboratories and shown to be quite reliable, as long as the measurements are not ill conditioned.

11:30 - 12:30 Freeform industrial metrology – state of the art and challenges
Dr. Enrico Savio, University of Padova, Italy

Abstract: The scope is to present the state of the art in the metrology of freeform geometry in industry. Some examples of products are presented, for which the metrology of freeform shapes is important to guarantee the desired functional performance. A review of the most important measuring techniques is presented along with their capabilities for freeform measuring tasks. Specification and verification of freeform surfaces, including data evaluation and comparison to specifications are discussed, along with the measurement uncertainty and traceability of freeform measurements.

12:30 - 13:30 LUNCH

13:30 - 14:00 Toward a Standardized Approach for the Evaluation of Hand-Held Laser Scanner Performance
Chris Blackburn, Large Scale Coordinate Metrology Group, NIST

Abstract: Advances in 3D scanning technology in recent years have enabled hand-held laser scanning instruments to enjoy increasing popularity as viable solutions to some challenging measurement problems. While this new technology continues to generate a lot of excitement across many fields, there is currently no standardized approach to the important task of characterizing the performance of these instruments. This talk will focus on my work at NIST studying a number of performance measures that such a standard might address. These include potential reference artifacts that could be developed to test hand-held laser scanners; how the scanner stand-off distance and orientation relative to the part being measured affect measurement accuracy; and the ability of scanners to effectively measure materials with different optical characteristics—in particular, surface reflectivity.

14:00 - 14:45 Recent developments in micro CMM measurement technique at PTB
Michael Neugebauer, Frank Härtig, Otto Jusko, Ulrich Neuschaefer-Rube, PTB, Germany

Abstract: A growing number of industrial workpieces comprises micro-geometries with dimensions in the µm-order up to 1 mm which need to be measured. Examples are micro-gears, injection nozzles and fiber-optic components. To trace back these measurements reference standards are required which are calibrated with uncertainties typically below 100 nm. In our contribution we present different kinds of micro reference standards to test instruments and, moreover, to quantify influences of sensors and instruments on the uncertainty. Some of these reference standards have to be calibrated by µCMMs because of their complex geometry. To realize calibration uncertainties below 100 nm, specific investigations have to be carried out to compensate systematic effects of µCMMs as far as possible. We present some first results of the metrological characterisation of a µCMM obtained within a cooperation between PTB and a CMM-manufacturer.

14:45 - 15:30 Tolerances Verification for Inspection with CMM and Laser Scanning

Mr. Ahmed Mohib & Prof. Hoda ElMaraghy, University of Windsor, Windsor, Ontario, Canada

Abstract: The lack of standards for CMM tolerance verification techniques and the advances in 3D scanning technology have challenged industry practioners and researchers to seek different and beter tolerances verification processes and techniques. This presentation discusses the different challenges that face the inspection process and focus on the research being conducted in the Intelligent Manufacturing System (IMS) Center at the University of Windsor in this field. An approach is proposed for the use of tolerance verification techniques in modern Inspection software. The direct use of information contained in the CAD files with the tolerance specifications to improve the conclusions derived from inspection regarding compliance with the specified tolerances and designer intent are addressed. Specification and verification of regular shaped and free form features are discussed along with the alignment of the measured points coordinate system with the CAD coordinate system.

15:30 - 15:50 COFFEE BREAK - VENDOR TIME

15:50 - 16:20 Verification of Coordinates Measuring Machines (CMM) using a step gauge

Abdelhak Nafi, École Polytechnique, Campus de L'Université de Montréal, Montréal, Quebec, Canada

Abstract: Manufacturers of high precision mechanical parts need to check their coordinates measuring machines (CMM) periodically, quickly, and at low cost. There are several ways to inspect the performance of CMM using different measuring instruments. Standard ISO 10360 Part 2 may be used to check the machine performance but the choice of measuring position has an impact on the results and so affects the decision process regarding the state of the machine. This presentation introduces a practical method to check the performance of CMM using a step gauge and to estimate scale errors and out-of-squarenesses between axes. First the step gauge is measured in six pre-defined locations. Based on the identified machine parametric errors, a seventh location is automatically proposed to bring the test procedure in agreement with standard ISO 10360 while attempting to obtain the worst possible result. Graphical and numerical results for two CMMs obtained with a stand alone software program that reads the raw data file provided by COSMOS and GEOPACK will be presented.

16:20 - 17:00 Open Discussion in Metrology Issues

17:00 - 17:30 ACMC Business, Annual Report, Election of Officers

17:30 - 18:00 Open Discussion and Vendor Time

18:00 - 18:45 NETWORKING and CASH BAR

18:45 DINNER

AGENDA: Friday, 27 June 2008

08:00 - 08:30 CONFERENCE REGISTRATION
Continental Breakfast

08:30 - 09:15 A model for software validation of CMM performance in an FDA regulated environment
Anish Shah & Jordan Pepin, Advanced Inspection Services, Plymouth MN, USA

Abstract: Medical device companies have often taken diverse paths to fulfilling the primary goal of software validation: “Establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting its predetermined specifications and quality attributes.” Some medical device companies use a means focused primarily on a GRR approach with correlation requirements to historic parts. Others couple this with an “Input > Process > Output” approach that looks at software functionality separated from measurement uncertainties associated with the measuring device. The presentation focuses on a model for CMM validation from a CAD based approach that first validates data processes and management and then measurement uncertainty.

09:15 - 10:00 Considering measuring accuracy against cost when planning to set up a CMM laboratory for a specific task, and advice on uncertainty method applied depending on the accuracy of the task.
Edgar Arizmendi & Guillermo Navarrete, Centro Nacional de Metrologia, Mexico
Presented by Octavio Icasio Hernández, Centro Nacional de Metrologia, Mexico

Abstract: Depending on the measurement task and the required uncertainty of that task, the appropriate CMM and its temperature control should be chosen to set-up the corresponding laboratory. This is basic before engaging in designing the laboratory or before making a choice of a particular model of CMM. The cost grows very importantly as the accuracy of the CMM increases and the temperature control improves. This relationship between cost and accuracy is illustrated in this presentation. Also, the different methods of uncertainty analysis should be considered when a target accuracy is meant. At least four major uncertainty analysis methods are generally used. Advice is given as to which method to choose as a function of the range of accuracy the measurement task requires.

10:00 - 10:20 COFFEE BREAK - VENDOR TIME

10:20 - 11:05 Work in the ASME B89.4.21 committee relating GD&T and CMM inspection
Ed Morse, University of North Carolina at Charlotte (UNCC), Charlotte NC, USA

The B89.4.21 Project team (CMMs in Realistic Environments) is currently developing a document that investigates the process of CMM inspection to GD&T. This document discusses the interaction of a part's geometric specification – in accordance with the ASME Y14.5M standard – and the inspection of the part using a CMM, recognizing that other measurement processes may supplement the CMM measurements. It is recognized that the outcome of inspection will be influenced by the programmer's decisions related to fixturing, probe selection, measurement point placement, and (software) algorithm selection. This document addresses the meaning of the part specification, and how it can and should influence the programmer's decisions.

11:05 - 11:50 Bonus Tolerance and Datum Shift: CMM Implications
Evan Janeshewski, Axymetrix Quality Engineering Inc., Langley BC, Canada

Abstract: Material condition modifiers such as MMC and LMC are very common in GD&T specifications. The “bonus tolerance” resulting from MMC or LMC modifiers on the considered feature is relatively straightforward and handled well by CMM software. The “datum shift” effects of material condition modifiers on datum features, however, are

much more complex and difficult to address correctly using coordinate metrology. This presentation will illustrate the difference between bonus tolerance and datum shift using Y14.5 tolerance zone and hard gage concepts, and describe the issues that arise when coordinate metrology inspection is applied.

11:50 - 13:00 Open forum on the usage and effect of the MMC/LMC modifiers and general measurement issues

13:00 - 13:45 LUNCH - VENDOR TIME

13:45 CONFERENCE CLOSES

14:00 Tour: Ford Windsor Engine Plant
Optional—Details to be Announced