

Precision, Low-Cost Micromachined Calibration Tools for Vision-based Measurement Equipment

Hy D. Tran, PhD, PE
Project Leader, Length/Mass/Force Metrology
Primary Physical Standards, MS-0665
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185-0665
Tel: (505)844-5417 Fax: (505)844-4372
E-mail: hdtran@sandia.gov

Meghan Shilling, PhD
Length/Mass/Force Metrology
Primary Physical Standards, MS-0665

Andre Claudet, PhD, PE
Mechanical Engineering
Engineering Design and Integration, MS-1064

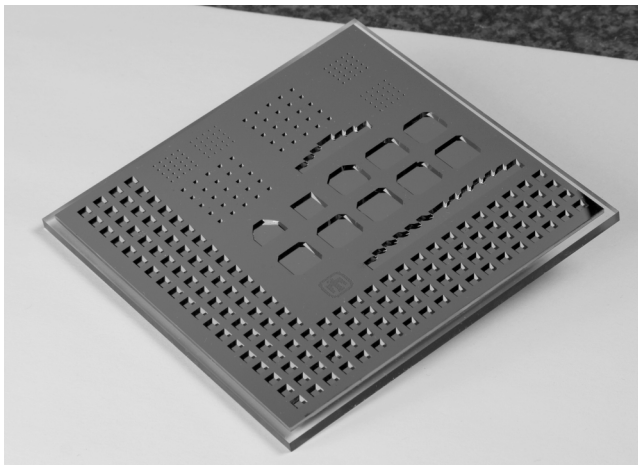
Technology Description

Can you improve the accuracy of equipment used to inspect millimeter-scale parts?

- The limiting factor for calibration of vision-based and multisensor (combined vision and tactile) equipment is typically the calibration standard used (typical vision-based calibration standards have accuracy on the order of $1\mu\text{m}$).
- Typical equipment repeatability is much better than actual stated accuracy.
- With our calibration tool, you can leverage the instrument repeatability and achieve better accuracy without replacing the equipment.

The silicon bulk-micromachined calibration artifact has the potential to:

- Improve accuracy of existing equipment by a factor of 2 or better.**
- Reduce cost of calibration artifacts used by end-users, or used by field service organizations.



Our artifact is fabricated by silicon bulk micromachining, which uses the underlying crystalline structure of silicon to create extremely sharp edges to relatively large planes (millimeter in size).

We then use a high precision coordinate measuring machine (CMM) with sub-micrometer performance to calibrate the standard.

The same edges detected by the CMM are used to calibrate the vision-based equipment used in product inspection.

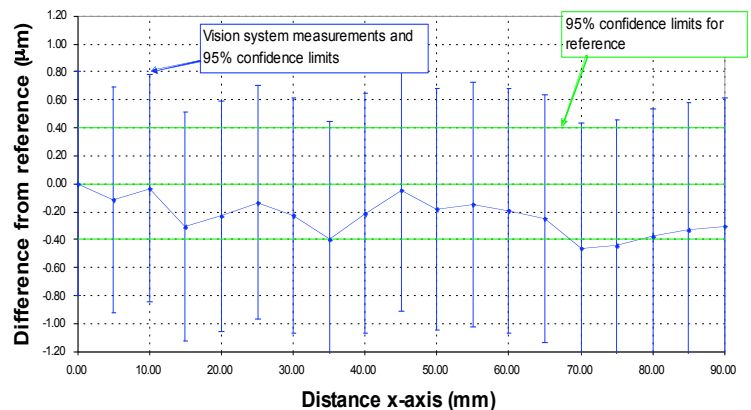
Commercialization Readiness

A prototype design was tested using both a high precision CMM and a commercial vision system. This proves that we can improve accuracy of existing vision-based measurement equipment.

Manufacturing leverages existing silicon micromachining infrastructure.

Data show that we can improve the accuracy of an existing vision system by a factor of 2.

Comparison of Vision to CMM



Potential Markets & Applications

A 2006 study estimated an installed base of 107,500 vision-based machines worldwide.

Manufacturers of vision-based equipment or multisensor systems can use this tool as a field upgrade for their existing customer base or to replace their existing calibration technology.

Machine owners or end users can use this tool as a standard for equipment calibration or a check gage to verify equipment performance.

Intellectual Property Position

A patent application for this technology was filed by Sandia National Laboratories in October 2007. This technology received an R&D100 award in July 2008.



This work was supported by the Laboratory Directed Research and Development Program at Sandia National Laboratories. Sandia National Laboratories is a multi-program laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin company, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

