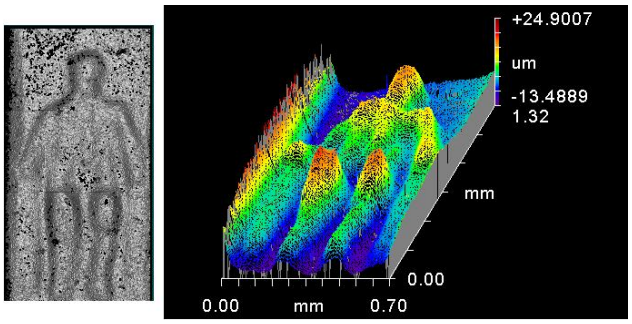
Coordinate Metrology for Mesoscale Devices

Meghan Shilling, advisor: Thomas Kurfess

With the increased precision of machines and processes, many devices are becoming smaller. As hard drives shrink, their internal parts, such as ball bearings, are shrinking with them. The LIGA process is being used to manufacture small scale motors and gears. As manufacturing processes produce smaller and smaller parts, it becomes critical that these parts are measured precisely. Measuring a ten mm part to the accuracy of a micrometer is common, and yields an accuracy to dimension ratio of 10,000:1. However, a similar reduction in a part that is on the order of 1 mm requires a 100 nm measurement capability.

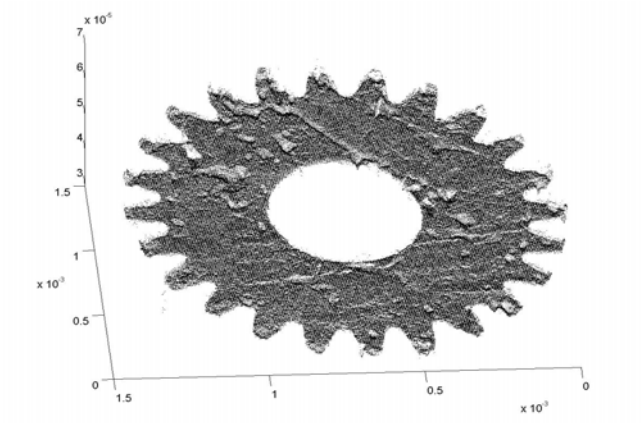
Devices such as interferometers, permit the creation of coordinate data that represents the surface of part, called a point cloud. A set of tools is available to make use of point clouds to extract critical geometric parameters. These tools minimize the deviation of the data points from parametric surfaces such as spheres, cones, and tori.



A picture and surface profile of Lincoln from the back of a penny. A white light interferometer was used to acquire this profile.

Current research is targeting process improvement for mesoscale manufacturing processes, in particular the LIGA process. Presently, two analyses of LIGA parts based on their two dimensional cross section are being investigated. If the cross section of LIGA parts are consistent throughout the part, then the two dimensional approach is sufficient to qualify. Thus, instead of surfaces such as spheres being fit to the data, circles and lines are fit. First, however, it is necessary to analyze LIGA parts to determine if a two-dimensional representation is sufficient. If so, these different tools could be used to more quickly and easily analyze the results of the LIGA process.

In addition to the analysis of LIGA parts, future work includes automation of the data collection process. The automation will allow for easier and more thorough data collection.



Plot showing coordinate data from a microgear (about 1.5 millimeters in diameter) made using the LIGA process.

Meghan Shilling is a masters student working on research in the area of coordinate metrology. She received her BS from Rose-Hulman Institute of Technology in the spring of 2000 and started her graduate program at Georgia Tech in the fall of that year. She plans to graduate from Georgia Tech with an MS in mechanical engineering in the spring of 2002. She is currently looking for opportunities related to her research interests: MEMS and coordinate metrology.

For more information, please contact Meghan Shilling directly at: gte642w@prism.gatech.edu

To learn more about other research at Georgia Tech, please contact Scott Billington at:

scott.billington@marc.gatech.edu
Georgia Institute of Technology
Manufacturing Research Center
Phone: 404-385-0895