Portable, Affordable

Calibration

Omax Corp. (Kent, WA), a manufacturer of waterjet and abrasivejet systems, had called in an outside calibration service to correct linear accuracy issues affecting its machine tools. The value of this service was immediately clear, however, the cost incurred from the use of an outside service was quite high. So when it came time to ensure that its machine tools met published specs before shipping, the company opted to purchase its own calibration system from Compton, CA-based Optodyne Inc. Says Dr. John Olsen, Omax co-founder and vice president of operations, "It is very economical and very portable, which is essential for field maintenance."

Generally, waterjet and abrasivejet systems cut composites, metal and glass with a focused stream of water pressurized up to 50,000 PSI. Abrasive jet systems inject garnet abrasive into the water stream to enhance performance. The small diameter garnet laden stream produces a very smooth and precise cut.

Waterjet systems can be fairly large; for example, the largest Omax system is 80 by 160 inches. Typically, its systems provide linear accuracy up to ±0.003 inch over entire travels at a 70 F ambient machine temperature.

When the ambient machine temperature fluctuates, maintaining tolerances can be difficult, particularly on larger parts. The larger the machine the more susceptible its ballscrews are to thermal growth. According to Olsen, "Every degree change in temperature changes the linear-accuracy of a 100-inch ballscrew by 0.001 inch across its length." The system helped Omax to discover a periodic error of the ballscrew and pinpoint several other sources of machine error, which allowed it to take corrective action that significantly improved accuracy.

Omax Corp. uses a laser-based calibration system from Optodyne Inc. to ensure the accuracy of its waterjet and abrasivejet systems, used to cut composites, metal and glass with a focused stream of water pressurized up to 50,000 PSI. Source: Optodyne Inc.

Laser Calibration Technology

The Optodyne laser meets NIST trace ability requirements and has a stability check of better than 0.1 parts per million (PPM), accuracy of 1.0 PPM and resolution up to 1 micro inch. Additionally, to compensate for thermal expansion, the system automatically adjusts to environmental factors, including barometric pressure, air temperature and material temperature. Based on patented Laser Doppler Displacement Meter (LDDM) technology, the system works by aligning a tuned laser beam along an axis, then reflecting the beam off of a target at various increments. The beam is detected, and the data is processed for displacement information.

The measurement process begins by positioning the reading head at the home position and specifying the measurement increment. When the machine tool moves, the system automatically senses movement, and after an operator-defined interval, the table stops and automatically collects data. The process repeats at each specified measurement increment along the length of the axis.

In shops subject to varying temperatures, it may be appropriate to generate a compensation table for different temperatures. Deviations between the scale and the positions measured by the laser are identified,

**Benefits**

* After purchasing an Optodyne laser calibration system to ensure linear accuracy of its machine tools. Omax Corp. discovered benefits such as improved field service, validation of vendor-supplied components and the ability to provide better information to its customers.

* In shops subject to varying temperatures, the calibration system can be used to generate a compensation table.

* Because it is based on Laser Doppler Displacement Meter technology, the calibration system requires only two optics, and they mount onto the machine.
which are used to calculate a compensation table. In some situations, a single linear correction factor can be used. In others, nonlinear incremental correction factors must be applied. Additionally, metrology software can automatically generate a compensation table in the format of many leading controllers. Omax calibrates every machine with the laser calibration system and records the information inside the system's control box before shipping. The company has found that the system is useful in the field.

The system is compact, fitting in a large briefcase, and easy to take on field service calls. Because it is based on LDDM technology, it requires only two optics, and they mount onto the machine. This means a quick setup time, as well as a speedy alignment of the beam.

**BETTER INFORMED CUSTOMERS**

The laser calibration system also generates straightness and squareness information, which has been a substantial benefit for both Omax and its customers. The measurements, which can be easily obtained with laser calibration equipment, provide customers with the information necessary to determine if the machine's performance will meet their needs.

Shown here is the laser measuring the diagonal across the 80160 Omax machine, to adjust the Y-bridge for squareness. *Source: Optodyne Inc.*

"Publishing the linear, straightness and squareness information of our systems has been beneficial because now the customer has ample information to make a better informed purchase decision," says Olsen. "It's been a powerful marketing tool because few other manufacturers bother to publish this valuable performance data."

The measurement of linear accuracy only provides the distance between points along an axis; linear measurement does not consider straightness or squareness. Straightness is the condition in which a specified area of a surface or axis is a straight line, free from bending, warping or twisting. Squareness refers to a 90-degree intersection of surfaces or axes. A machine tool with axis travels that are not straight or square will have great difficulty cutting precision prismatic parts or parts with curved surfaces.

"The Optodyne laser calibration system helped us improve our products and processes in many ways that we discovered only after we had purchased our first system and began using it," says Olsen. "The ability to make critical information about our system accuracy available to our customers—information that our competitors do not provide—has helped us immensely."

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