Application Notes **AP1105**

Rotary Table Calibration without using a Reference Rotary Table with a Hirth coupling

I, What is the problem

Conventional techniques to calibrate a rotary table are based on the comparative method. Usually, a reference rotary table with a Hirth coupling (a rotary calibrator) is used in conjunction with a laser interferometer angular measurement system, an autocollimator, or an electronic level (used on vertical tables). The accuracy of the calibration is limited by the accuracy of the reference rotary table. An accurate reference table with a Hirth coupling is very expensive, heavy and must be calibrated independent of the laser system.

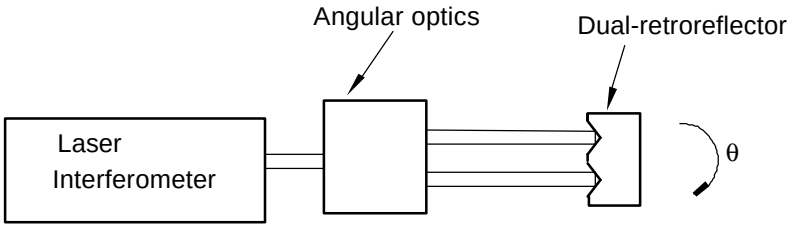
II, How LDDM Solves the problem

The LDDM dual-beam laser system is based on the laser Dopplermetry. It can measure both linear displacement and angular displacement simultaneously. As shown in Fig. 1, laser interferometer can only measure the rotational angle of the dual-retroreflector, while the LDDM dual-beam laser system can measure both the linear position and the rotational angle simultaneously. This additional information enables the dual-beam laser system to calculate the center of rotation and the beam separation. The errors caused by run-out, wobble, parallelism and non-coaxial, can also be minimized. Hence the rotary table can be calibrated directly without the need of a reference rotary table with a Hirth coupling.

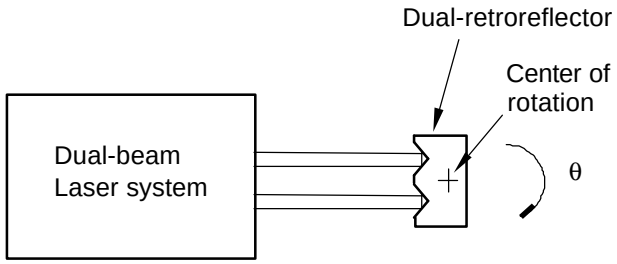
III, How it works

The LDDM Dual-beam system can measure the rotational angle of a dual-retroreflector up to $\pm$ 10 degrees. With a small turntable, the angular measurement range can be extended to 360 degrees.

First turn-on the LDDM system and connect the output through the RS-232 cable to a Notebook computer. In the Windows™ program, click on the Optodyne icon to show the main menu. Click on the "rotary calibration" button. The screen will show the linear position reading and the angular position reading.



Measures the rotational angle only.



Measures both the rotational angle and the center of rotation.

Fig. 1- A comparison of rotary table calibration technique
using a laser interferometer and a dual-beam laser system

Place the dual-retroreflector on top of a small turntable, which is in turn mounted on the rotary table under calibration. The rotary table is programmed to move in incremental steps of any angle. At the end of each step, stop for a few seconds, the angular and linear position data will be collected automatically (or manually by pressing the space bar). After each step, rotate the small turntable in the opposite direction to prevent laser beam break and stop for a few seconds. The residual angular and linear position data will be collected automatically. Continue the same sequence until reached 360 degrees. After data collection, click on the "analysis" button. The data will be analyzed and the angular position errors calculated. The results can be expressed in degrees, arcseconds or microradians.

IV, Need more information

Call Optodyne, Inc. at 310-635-7481 or your local representative.