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THE GONIOMETER ON LASER GYRO BASE

With a help of a laser gyro such instruments as goniometers, devices for measurement of the glass refractive index, geodesic and astronomical angle measuring devices and other can be developed. The utilization of laser gyro in angle measuring instruments allows to increase the accuracy, reliability and measurement reproducibility, to decrease the time of measurements, to automate the process of angle measurements.

The first experimental goniometer on laser gyro (LG) base was designed at the D.I. Mendeleyev Institute for Metrology (St. Petersburg, Russia). The first commercial angle measuring instrument on LG base was produced in the early 1980s by the Arsenal plant (Kiev, Ukraine). It is the goniometer-spectrometer GS1L that is being produced on commercial basis and exploited at many plants in Ukraine and abroad. The commercial laser goniometer system EUP-1L is designed by the St. Petersburg Etectrotechnical University.

The simplified scheme of the goniometer on LG base is given in the figure 1. On rotating device 1 are mounted: object table 2, prism 3 under check, the angles of which are to be measured, laser gyro 4. Rotating device 1 rotates with a constant speed with the aid of electric motor 5 con-trolled by electric drive unit 6. Close to table 2 mounted is photoelectrical slit autocollimator 7. During rotation of rotating device 1 with prism 3 the electrical pulses are received from each face of the prism at the autocollimator output. From the base face tie unit 8 the signal of selection of the first prism face is received. With the aid of this signal the control unit 9 selects the autocollimator pulse from the first face of prism 3. This pulse actuates pulse counter 11 which begins counting the number of signal periods of laser gyro 4. The counter 11 is stopped by autocollimator 7 pulse received from the second prism face and finishes counting the number of signal periods of laser gyro 4 while the counter 12 begins counting. With coming of autocollimator 7 pulse from the next prism 3 face, one counter turns on while another turns off. The information from counters 11 and 12 is transmitted to computer 14 with the aid of communication device 13.

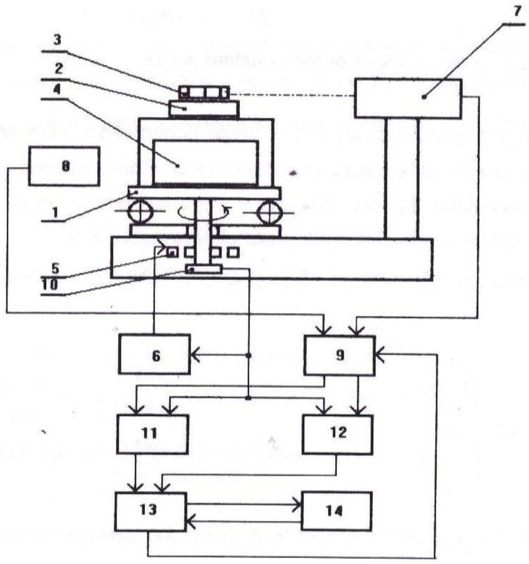

Fig. 1 The scheme of goniometer on laser gyro base

Thus the numbers received by computer within one full turn of rotating device 1 are as follows:

from counter 11:

$$N_1 = \int_{t_1}^{t_2} f_{out}(t)dt,\ \ N_3 = N_1 + \int_{t_3}^{t_4} f_{out}(t)dt,\ \ldots,\ N_{n-1} = N_{n-3} + \int_{t_{n-1}}^{t_n} f_{out}(t)dt,$$

from counter 12:

$$N_2 = \int_{t_2}^{t_3} f_{out}(t)dt,\ N_4 = N_2 + \int_{t_4}^{t_5} f_{out}(t)dt, \ldots, N_n = N_{n-2} + \int_{t_n}^{t_{n+1}} f_{out}(t)dt,$$

where t_1, t_2, t_3,..., t_n, t_{n+1} is the time of autocollimator pulse coming from the first, second, third, etc. prism faces and then again from the first prism face; $f_{out}(t)$ is the frequency at the output of laser gyro; n is the number of faces of the prism under check.

Implementation of laser gyros in angle measuring instruments allows to increase the accuracy, reliability, and measurement reproducibility, to considerably decrease the time of measurements, to automate the process of angle measurement.