SIMPLE LASERMIKE FOR MEASUREMENT OF DIMENSION, FORM AND POSITION OF CYLINDRICAL ELEMENTS

Ryszard Jabłoński*, Maciej Kretkowski*, Paweł Fotowicz**

In lasermikes (laser measuring scanners) the measurement information is converted to become time-dependent by scanning. An object to be measured is scanned transversely by a laser beam waist. An angular scanning is transformed into linear by scan lens and the detector output signal is of the form of shadow of an object. Assuming constant scan velocity, the shadow time is the measure of the size of an object. A quick scanning of a beam makes lasermikes indispensable in all kinds of dynamic operations. There are four main areas of application : read/write/ display, technology, medicine and measurement.

In the presented paper the scanned laser beam is split into two mutually orthogonal beams giving information not only about the dimension, but also about the position and the form of an object. The reference standard introduced within the measuring area enables the simultaneous calibration of the system. We used the simple polygon-mirror-based scanner driven by synchronous motor. The system operates in the 10×10 *mm range with resolution* $0.1\,\mu$*m.*

Key words : *lasermike, laser measuring scanner, intensity distribution*

1. Introduction

Lasermikes (LMS, laser measuring scanners) comprise the wide range of instruments : from simple, pocket size gauges to stationary, laboratory and industrial measuring systems. All kinds of scanners continuously improve their characteristics but the electro-mechanical (e-m) ones undergo the fastest progress. LMS makers, like Zumbach, Beta, Mitsutoyo, Tokyo Seimitsu produce e-m scanners of measurement rate up to 1 000/s, measuring range from 100 μm to 50 mm and accuracy about 0.2–1 % (some reach scan rate of 30 000/s). Of course the highest resolution is at the slowest scan rate. The best results are obtained for small-size cylindrical objects measured statically in laboratory condition assuming negligible small cosine error.

The principle of operation of lasermike is presented in Fig. 1. The laser beam, collimated and filtered by Beam Forming Optics (BFO) is scanned by deflector DEF. An angular scanning is transformed to linear by scan lens SL.

If the cylindrical object OB of diameter d is placed in measuring area perpendicularly to the scanned beam and the detector unit (DU) further behind, the measured diameter will be proportional to the 'shadow time' Δt and therefore to the angular difference $\Delta\theta$ (the

* Ryszard Jabłoński, Maciej Kretkowski, Warsaw University of Technology, Faculty of Mechatronics, Sw. A. Boboli 8, 02-525 Warsaw, Poland

** Paweł Fotowicz, Central Office of Measures, Elektroralna 2, 00-950 Warszawa, Poland