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Improvement of Measuring Accuracy of Laser Diameter Gauges

ABSTRACT - Masterthesis

Accurate determination of geometrical parameters of optical fibers is important for the fiber rich network performances. Because of the improvements in the manufacturing process of optical fibers, and the requirements of tight tolerances in connection technologies, geometrical characterization of optical fibers during the manufacturing process is even more important nowadays.

As a manufacturer of commercial dimensional metrology systems, the SIKORA AG has under development a diameter gauge for measuring optical fibers and wires having diameters between 100µm and 3mm. As all other diameter gauges of SIKORA, this diameter gauge is supposed to work with the Laser shadow projection principal. According to the customers needs and standards, measuring accuracy of 0.05µm should be achieved by this gauge. This accuracy has to be maintained within a measuring field of 5mm by 5mm. Before the beginning of the project, an error of ±0.2µm to ±0.3µm was achieved by the research and development department of SIKORA AG.

In this paper a review of the theoretical background of the operating principal of the laser diameter gauge is given and critical components employed in the diameter gauge are identified. Furthermore, potential reasons for the encountered variation of the measured diameter values within the measuring field will be analyzed using the various results of the experiments and the possible improvement methods for the accuracy of diameter measurements will be discussed.