

In-line inspection and measurement of DVD-RAM

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ABSTRACT

The in-line inspection and measurement of DVD-RAM discs during production is more sophisticated compared to the inspection of other optical disc formats. The presentation will give an introduction in the optical disc inspection with an in-line scanner. The special task with DVD-RAM inspection is explained more detailed. The presentation shows the image processing and the principle of the defect detection on a structured disc surface. Also the disc deviation measurement is explained with an example. At the end the advantages and the principle of a multiple step defect detection in a DVD-RAM production line is described.

Keywords: In-line inspection, header detection, DVD-RAM, deviation, multiple step defect detection, image processing

1. INTRODUCTION

Dr. Schenk manufactures inspection and measurement equipment for all optical disc formats since 1985. The first surface inspection system for magneto-optical discs was integrated into a production line in 1994. The in-line inspection of structured discs presented a new challenge for quality control equipment suppliers.

2. IN-LINE INSPECTION AND MEASUREMENT

2.1 Optical disc inspection scanner

The optical disc inspection scanner examines in transmission or in reflection the quality of an optical disc. To this end illumination units and line scan cameras are used. An optical disc inspection scanner can consist of two illumination units and two camera units, one unit to inspect each disc side. Every line scan camera measures with a pixel resolution of 2048 or 4096 pixel and generates an electrical signal which is processed in the electronics unit to show defects on or in the optical disc. To guarantee a stable and correct light power a light power sense is used on every illumination unit as feedback for a light-power control loop. The cameras are gain controlled by the software. The camera scan frequency is adjustable up to 19800 Hz.

2.2 Special tasks with DVD-RAM inspection

The pre-recorded header structure requires image processing algorithms for optical inspection. The system needs to differentiate between headers and defects with same level of contrast. To this end the inspection of the header area and the data zone is performed with a different sensitivity. Compared to other optical disc specifications the DVD-RAM must be inspected with tighter tolerances for the radial deviation. At the final stage of the production a check of the initialization is necessary.

2.3 Image processing of header structure

The headers of a DVD-RAM are recognized by pattern recognition methods. The features of the headers are contrast, width, length and radial position. Before inspection a teach-in procedure is required. The teach-in procedure generates a table with the features of the header structure. This table is stored in the scanner memory. The taught and stored header features are compared to the inspected disc during the inspection process. The single automatic teach-in procedure enables an easy adaptation to future disc formats.

2.4 Defect detection on DVD-RAM

The received camera signal is processed in the electronics unit. Every inspection scan is an image of a radial line of the optical disc. Figure1 shows the received and pre-processed signal of one scan line. The diagram shows the reflected light intensity dependent on the radial position on the disc surface.

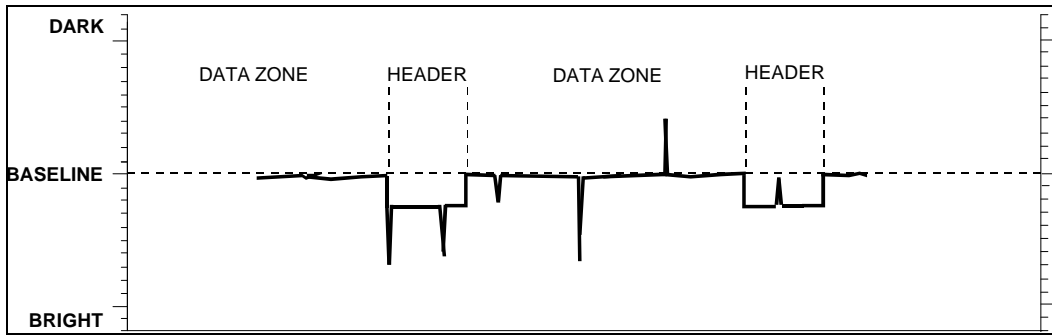


Figure 1: Received and pre-processed camera signal of a scan line

Headers have a higher reflected intensity than the data zone. This leads to a contrast difference which can easily be detected. Dark or bright defects are detected by their differently reflected intensities i.e. signal amplitudes and signs. The received signal is compared to different thresholds. The scanner system knows header structure and size. This enables the detection of defects in the transition area between data zone and header.

2.5 Deviation Measurement

The deviation of the disc is measured by a triangulation method. The radial and tangential deviation is measured with a 2-dimensional position sensitive sensor. The vertical deviation, vertical runout and vertical acceleration are calculated based on of the measured values.

2.6 Multiple Step Defect Detection

The multiple step defect detection is used to combine the inspection results on different production steps. In-line scanners are important for the detection of randomly occurring defects and for the continuous quality control of every manufactured disc in order to guarantee that not a single bad disc leaves the factory.

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