A FAST METHOD FOR QUALITY CONTROL OF WOLFRAM WIRES COATINGS

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ABSTRACT
The continuously increasing need for technologically advanced products in industry requires the development of objective measurement and control methods for different materials, processes and production itself. The producers must be sure that all products are defect free, without faults or other undesired properties. Recently a series of articles [1-4] were published by this author characterizing a newly developed modular system called Noviscam (Novel visualisation system for control and monitoring) devoted to fast automatic control and on-line monitoring in the real time of flat product processes. In these articles the main parts of the system developed for universal usage of surface appearance irregularities were described. Here we can describe the processing of the developed software for monitoring and quality control of the real product coatings and surfaces. The process uses analysis of the data to determine deviation from uniform condition in running and static mode. In running mode the software divides every frame into a selected number of vertical and horizontal stripes. The program checks if the calculated values are within the specific tolerances. In static mode the program analyses individual frames. The frame is divided into specific number of cells. Every cell has own position defined by the axis and a given value. Data evaluation is implemented in software. We would like to confirm the universality of the modular system especially its expansion in monitoring and control of wolfram wire coatings and the effect of chemicals on structure .The research work is supported by projects VCARTEC 1M 0554 and FRVŠ 1455/2010 of MŠMT ČR.
Keywords: automatic control of surface irregularities, analysis of individual frames, eccentricity.

1. INTRODUCTION

Our research work focuses on the development and application of the means for computer image analysis of dynamic processes. The goal is to affect the quality of the flat products and quantify the changes after treatments or modifications. The work was intended to develop a suitable software toolbox for dynamic and static analyses of the flat products and production processes. For the automatic control on the machines and the appearance irregularities in the real time we developed modular system.

2. MATERIALS AND METHODS

2.1. Materials

We used two different fabrics. One was metal fabric from wolfram wires [7]. The second was jute fabric treated by chemicals. Our intention was to investigate adhesion of copperized wolfram fabrics and effect of chemicals on jute fabric structure as well. In both cases appearance irregularities were evaluated. For investigation of these two different fabrics softwares were developed.

2.2. Methods

First a modular system was developed for image analysis. Images are obtained from 3CCD camera or videorecorder and scanner. The modular system characteristics are as follows:

a. Operating principle:
An illumination system directs beam of light evenly across the width of the fabric.
A 3 CCD camera receives the reflected light, the intensity and color variation of which deviates noticeably in the presence of a defect. Data can be analyzed using various methods and algorithms.

b. Requirements for all used algorithms:
Must be flexible enough to enable the best parameters for analysis to be selected and compared with other methods. It must be fast enough for on-line and in real time control.

c. Technical parameters of the system:

- 25 pictures per second,
- time needed for one picture is 40 ms,
- speed of the process is up to 10 m per second,
- the file is in size 720x576 pixels.

3. DEVELOPED SOFTWARE

This analysis is devoted for measurement of appearance irregularities (non-uniformity) of the flat products. The program processes a video signal (YUV), which was originally received by DPS Reality Card and passed to the program in a suitable digital form. The processing uses statistical analysis of the data to determine deviation from a uniform condition in running mode. While the running mode employs real time processing and analyses continuous flow of frames, the static processing is applied to selected single frames and allows more detailed analysis [3].

3.1. Running mode

In running mode the computer divides every frame into a selected number of vertical (in direction of production process) and horizontal stripes (Figure 1.).

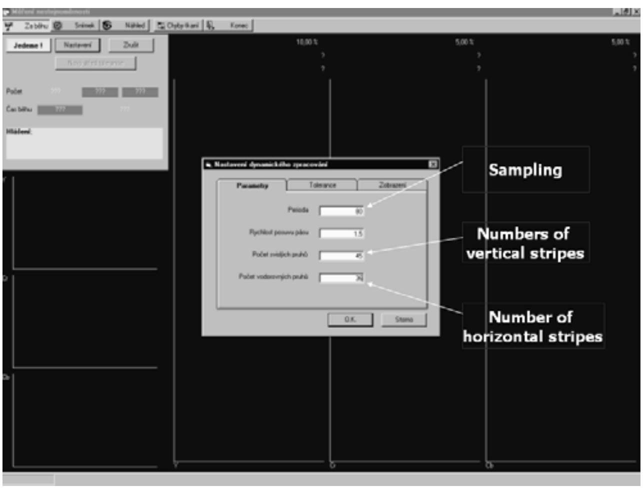

Figure 1. Principle of measurement – arrangement of real speed and number of cells (number of columns and lines)

The program checks if the calculated values are within the specified tolerances (one dot for each frame). Cases over the tolerance limits are recorded and reported (Figure 2.).

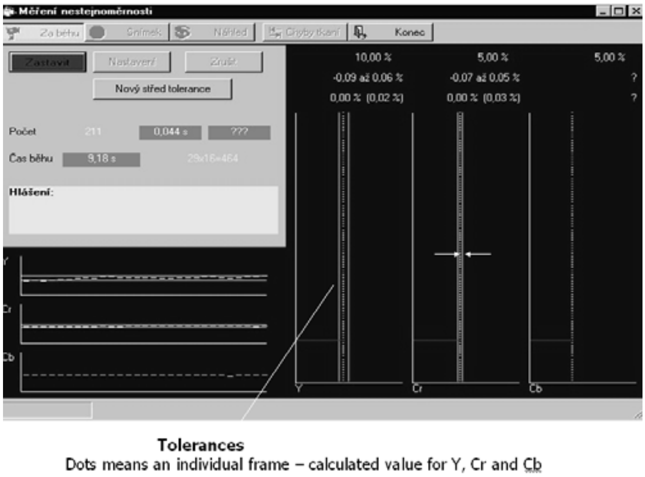

Figure 2. Principle of measurement – arrangement of tolerance limits for Y, C rand Cb

3.2. Static mode

The program analyses individual frames selected by the "collect frame" command.
On this command the frame is transferred from current memory and statistically processed.
The frame is divided into a specified number of vertical and horizontal stripes (Figure 3).
For each such generated oblong the program calculates the mean value of color components, minimum and maximum values and standard deviations across the whole frame. Click of a mouse on a specific part of the frame provides values at this point.

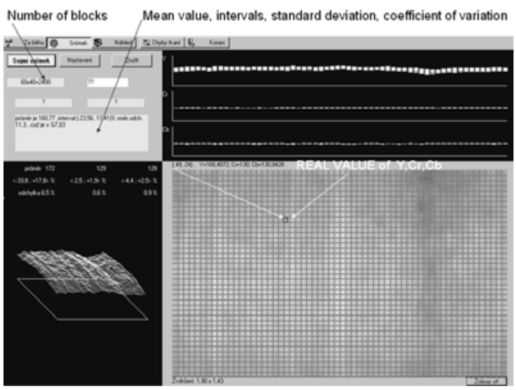

Figure 3. Principle of measurement – the static mode – chosen cell (block) – position [0;0], the value of Y,Cr,Cb.

4. MORE DETAILED ANALYSIS APPLIED TO SELECTED SINGLE FRAMES

There are many algorithms used for fault detection [3,5,6]. First we concentrate on fault discriminating based on shape. For each fault eccentricity is calculated as follows:

$$\text{Eccentricity} = \frac{\max(\text{xd}, \text{ya})}{\min(\text{xd}, \text{ya})} \cdot 0{,}7854 \tag{1}$$

where: xd is dimension of the fault in the x-direction
yd is dimension of the fault in the y-direction
ya is area of the fault/xd

Thus, ya is the apparent dimension in the y-direction, based on the area and the x dimension. The factor 0,7854 converts the result so that a circular fault results in an eccentricity of 1,0, a square results in a value less than 1,0 and thread shapes result in number greater than 1,0. Eccentricity, then is a number which behaves as follows (figure 4.):

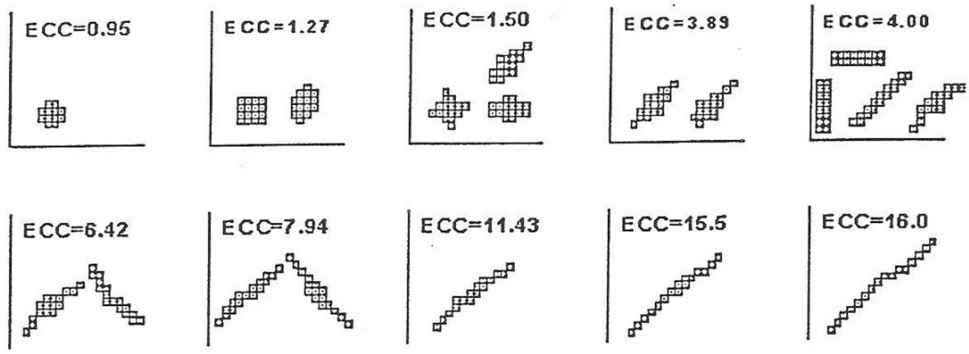

Figure 4. Fault discriminating on shape

The calculated eccentricity value for any detected fault allows to create categories for the real fault.

5. CONCLUSION

In this paper there is approach to automatic inspection on various type of flat fabrics on-line and in real time.

- The modular system can be positioned “in-line” as part of a production process, or “stand – alone” as a separate inspection unit.
- The used software can identify small and large defects and uniformity of fabric.
- The modular system measures textile shade and colour consistency during fabric flow.
- The eccentricity is a number that describes the shape of the irregularities or faults.
- The modular system adapts to a variety of applications.

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