

Analysis of Fabric Properties Using Digital Fabric Simulator

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Abstract:-The area of the digital image processing is getting more attention in the hope that it will increase the accuracy of any scientific measurements. One of many digital image processing applications is texture analysis. Fabric or cloth is a flexible artificial material that is made by a network of natural or artificial fibers. Fabric fault inspection is an important process in the textile industry. Faults present in the fabrics are the major reason of the rejection of the fabric which creates lots of loss to the industries. Fabric when processed in textiles the fault present can be detected by upgraded process for measurement of weft angle, fabric density can be identified using MATLAB with image processing techniques. This image processing technique [1] is done using MATLAB 7.10 using the image taken by the video camera. The Digital Fabric Simulator can detect the fault on the cotton, denim and polyester fabric considered in this paper.

Keywords:- Fabric simulator, Weft Angle, Fabric Density, Haugh transformation

I. INTRODUCTION

Fabric fault inspection is an important process in the textile industry. Most of the industries get the loss due to the faults present in the fabrics. A complete fabric analysis comprises not only the inspecting arrangement of warp and weft threads of the fabric but also includes the quality, counting of the number of twisted yarns, weight of the fabric per yard, structure of fabric and other many parameters related to the types of fabric. Currently much of fabric inspection depends on human visual inspection which is very tedious and time consuming and even with the most trained inspectors. This inspector cannot detect the 100% defect of the fabric [1]. Performance and assessment of the inspector can affect by the load on that inspector and also due to the fatigue which cause the slow speed of human visual inspection compared to production rate, automatic inspection. Processing and analysing digital images of fabric using different techniques as Fourier transformation, wavelet transform approaches [2, 3]. Recently Automatic on-line quality control can be done using the video cameras and suitable software viz. MATLAB. The weft angle and fabric density are the two important parameters that take part in fault detection are considered in this paper. The parameters weft angle and fabric density is measured for the fabric type cotton, denim and polyester.

II. FABRIC: A VISION

A fabric is a piece of cloth. Fabrics can be made by using a number of techniques. A textile or cloth is a flexible woven material consisting of a network of natural or artificial fibers referred to as thread or yarn. Yarn is produced by spinning raw fibers of wool, flax, cotton, or other material to produce long strands. Textiles are formed by weaving, knitting, crocheting, knotting, or pressing fibers together (felt). The words fabric and cloth are used in textile assembly trades as synonyms for textile. Textile refers to any material made of interlacing fibers. Fabric refers to any material made through weaving, knitting, spreading, crocheting, or bonding that may be used in production of further goods.

Fabrics knit mean woven together using “weft” and “warp” yarns. “weft” yarns are the thread that go back and forth, and “warp” are the up and down yarns parallel to the selvedge. These yarns are the structure for any kind of weave or pattern in a fabric. All sewers know the word “grain,” and this is referring to the weft and warp yarns. If a fabric is off grain there are two forms. Skew is when the “weft” yarns are not at a 90° angle to the “warp.” This occurs during processing and is common in printed fabrics before finishing. The second is called Bow and occurs when the “weft” yarns dip or curve in the center of the fabric. This also happens during processing. Fig 1 shows the internal structure of the fabric.

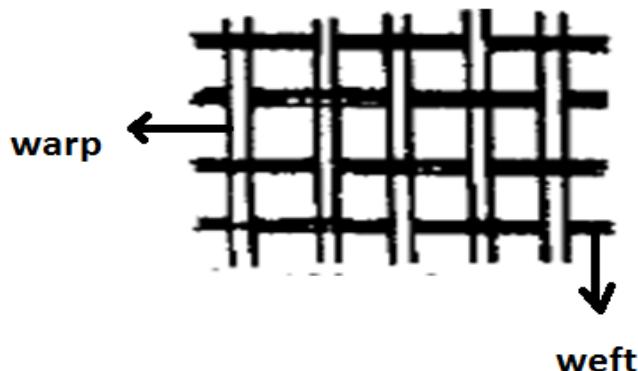


Fig 1: Internal structure of Fabric

In textile there are different types of fabric can be design using different methods. The fabric can be categorized based on the weaving method viz. knitting, laces, net, cotton, denim, polyester, embroidery. Cotton fabric comes from the natural fiber of the cotton plant. Cotton allows the skin to breathe and it wears and washes well, Polyester has high strength (although somewhat lower than nylon), excellent resiliency, and high abrasion resistance. Low absorbency allows the fabric to dry quickly, Denim is a rugged cotton twill textile, in which the weft passes under two (twice- "double") or more warp threads. The parameters considered to detect fault in the fabrics are defined as follows.

- **Weft Angle:** Angle between warp & weft is known as weft angle.
- **Fabric Density:** Calculation of fabric density is based on the density of fiberglass and Polypropylene for the fabrics used in the benchmark study.

III. ALGORITHMS AND DESIGN

The weft angle and Fabric density was measured using the two methods viz. Edge Detection- Hough Transformation, Morphological operations In this method first image capture by CCD camera & filtering this image, then find out FFT of image, then find IFFT of this image. First we find weft angle. For that we required only weft yarn it means only horizontal line, so warp yarn or vertical line is removed by loop apply to each yarn. Then it converting binary image by edge detection method, then detect line by using Hough transformation, find out the weft angle. Then find out uniformly fabric density, so weft line divide in five column, then count no of the white line in each column, it is our fabric density [4, 5].

In Morphological method first image capture by CCD camera & filtering this image, then find out FFT of image, then find IFFT of this image. For weft angle it required only weft yarn it means only horizontal line, so warp yarn or vertical line is removed by loop apply to each yarn. Then it converting binary image by grey thresholding, then converting thin line by using thinning morphological operation then detect line by using Hough transformation, find out the weft angle. Then find out uniformly fabric density, so weft line divide in five column, then count no of the white line in each column, it is our fabric density [5].

IV. SIMULATION SETUP: DIGITAL FABRIC SIMULATOR

A graphical user interface (GUI) [6] is a user interface built with graphical objects; the components of the GUI; such as buttons, text fields, sliders, and menus. If the GUI is designed well-designed, it should be intuitively obvious to the user how its components function. MATLAB have a feature to implements GUIs as figure windows containing various styles of uicontrols objects. We must program each object to perform the intended action when activated by user of the GUI. All of these tasks are simplified by GUIDE, MATLAB's Graphical User Interface Development Environment. Digital Fabric Simulator is graphical user interface design based on MATLAB [7] which can analyze the fabric fault using the weft angle and fabric density of the cotton, denim and polyester types of fabric.

Fig 2 shows the snap shot of Graphical User Interface Digital Fabric simulator designed to do the analysis of fabric using digital image processing and has following facilities:

- To change the different fabric type, such as cotton, denim, polyester.
- To change the different edge detection method, such as canny, sobel, prewitt.
- To change the different measurement method regarding the types of fabric and method applied.
- To initialize the model or image.
- To view results of different edge detection method, different measurement method of weft angle, fabric density, fault recognition of fabric in workspace & show output image in axis.



Fig 2: User Interface for Application

Fig 3 shows the snap shot of fabric simulator when we can select the different edge detection technique for the fabric from edger detection menu. Digital fabric simulator have different menu in menu bar, Such as documentation, fabric type, edge detection, methods, fault recognition, help, exit. It can also select denim, polyester. We can also select the edge detection operation performed on cotton fabric result. In fabric simulator select canny, sobel, prewitt method in edge detection method for different fabric. This fabric simulator have a menu editor through which it can be used the different documentation facility available regarding fabrics and its properties. It also provides the online help as one can require it.



Fig 4: GUI showing canny edge detection results for cotton

Digital Fabric Simulator provides the online help as one can require it. To get the help about the operation of fabric simulator user can get it by selection of help menu available in it and user can also get the online help about it for its fundamental by selecting online help from the help menu bar. Fig 5 shows the snapshot of the help menu in Digital fabric simulator.

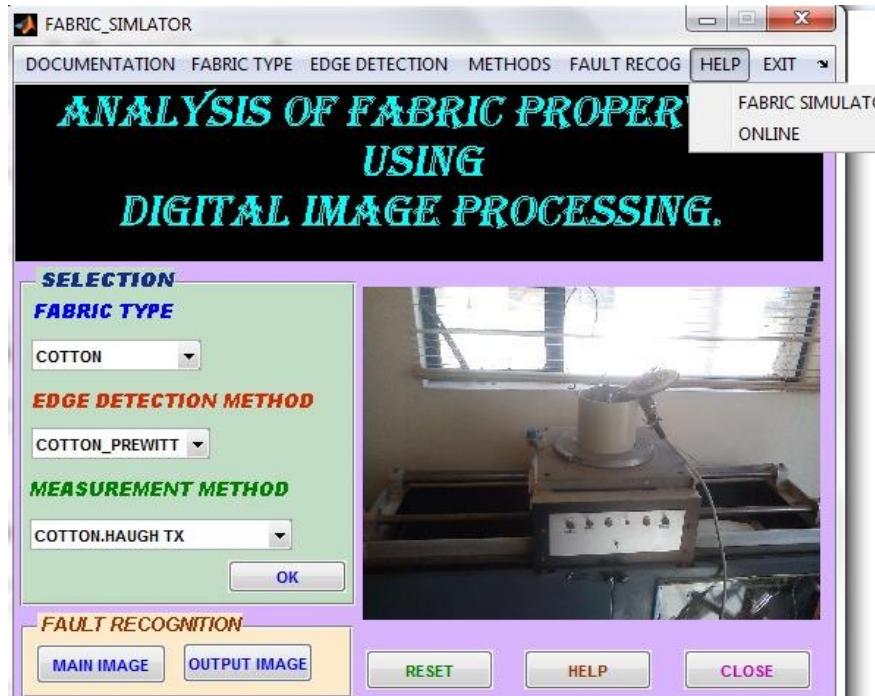


Fig 5: GUI showing the facility of online Help

V. CONCLUSION & FUTURE SCOPE

Digital Fabric Simulator is a user friendly analytical GUI that can facilitate to user for easy and efficient analysis of the different types of fabrics. It also can provide the facility of the edge detection and the menu operated simulator. It provides

the analysis of the fabric using the two different methods which can enhance the vision of the analysis of fabric using the latest digital image processing toolbox. The facility of the different analytical approach for the fault detection method can also be included in the future very easily.

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